JOURNAL OF GAS LIGHTING & WATER SUPPLY.

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EDITORIAL NOTES.

In the Parliamentary Committee Rooms.

THE session's Private Bill work has begun, has made in brief space good progress, and lament is already heard over the dulness of the session's prospect in the Committee rooms. There has been plenty of life in the corridors the last week or two; but the bustle has been associated with Marconi share operations, Putumayo atrocities, motor traffic, patent medicines, and other questions that have no immediate relationship with gas and water legislation. The inquiries into these matters have been, or are being, held in the Committee rooms with double figures as numbers, some of which rooms were, not many years ago, required, session after session, for overflow Private Bill work that could not be accommodated in the line of rooms with single numbers over the doors. Rarely now are even these latter rooms all simultaneously engaged. There is not the same old fighting spirit abroad over Private Bills. Abundance of petitions are lodged against measures; but these are often only, so to speak, safeguards, or a manner of reinforcing the position taken up by local authorities or other parties in operating for modification or concession. Promoters and opponents seem to be more willing than ever to negotiate, and to settle differences outside the Committee rooms, in which lurk for some of the parties the shadows of many a very expensive contest without any commensurate gain, and perhaps with complete loss. The peaceful mode has been having sway this session; and Bills are making rapid progress along the course of quite ordinary formality. It seems as though the parliamentary authorities themselves are doing their part in facilitating progress. Probably the restlessness and the uncertainty that exist in the parliamentary realm have something to do with this. There is, however, the fact that things are going along pleasantly and swiftly in the Private Bill branch of legislation. True, there are no particularly striking new masterpieces among the parliamentary schemes of the session. There are no extensive gas-works construction projects on the *tapis;* and in these days we do not get any big contested gas purchase schemes. Those that come before Parliament are either already agreed purchases, or else promotions for the purpose under formerly obtained purchase clauses—occasionally, under a suspensory clause. On the whole, therefore, we do not look for anything sensational arising out of the session's gas work.

There have been a few opposed Gas Bills before the Select Committees, but they have not raised any principle or point that calls for particular remark here, nor have they demanded any protracted discussion. A few matters of interest are dealt with in "Notes from Westminster." The chemical manufacturers have made no sign this session, either in the list of petitioners or since. They have evidently accepted as wise men the verdict of the Joint Committee appointed by both Houses to arbitrate upon the opposing claims of the chemical manufacturers and the gas industry. The decision was so sweepingly in favour of the retention of open markets for the raw residual products of gas manufacture that the chemical manufacturers prudently recognize that they have not now a leg upon which to stand before any Committee of Parliament. And they have in the immediate past the profitless void created by the considerable waste of money and time over their ill-advised campaign of last year. The matter was incidentally and indirectly alluded to when the Provisional Order of the Newton-in-Makerfield District Council was, in a Confirmation Bill, before the Unopposed Bills Committee. The Chairman merely asked whether the residuals powers were in conformity with the decision on the subject; and when it was pointed out to him by the Speaker's Counsel (Mr. Ernest Moon, K.C.), that the Order only continued the powers already granted, the matter was allowed to drop. One Bill has also gone forward in which, as introduced, the limiting words "by them" appeared in the general powers and works clauses; but the words have since been deleted. There are no indications at present of further steps in the promotion in the present session of a Joint Bill for the repeal of the "chemical clauses" and restrictions of similar effect placed in the Acts and Orders of last year.

Although there is within sight no sign of any deliberate attack on the liberties and rights of the gas industry that is likely to engross so much attention, and absorb so much time and money, as did the organized raid of the chemical manufacturers, that experience and others of somewhat minor character, and yet important, show that it will be necessary to keep a very sharp watch for innovations that are derogatory to the industry's interests. Already some of the county councils have been at work, trying to obtain protection in connection with roads and bridges beyond that which the general law allows. These piecemeal efforts on their part must be resisted, and not encouraged by ready compliance. Committees are not, as a rule, on the side of the county councils in this matter. This is one of the interesting points referred to in "Notes from Westminster."

The Manchester Denouement.

WHILE the Institution of Electrical Engineers and all its sections have been enjoying the version of the tale of the Manchester street-lighting experiments as supplied to them by Messrs. S. L. Pearce and H. A. Ratcliff, Mr. J. G. Newbigging and Mr. Pearce have been jointly working at the *dénouement*, and this (as our news columns showed last week) comes as the best possible criticism of the paper and the attempts that have been made to persuade lighting authorities that the flame arc lamp leads in cost, if not in quality of illumination. The electrical papers have cried aloud to electric supply authorities to make every possible use of the results of the Manchester tests; and, where this has been, and is being, done, there has been an utter disregard of the fully explained defective conditions under which the high-pressure gas-lamps were installed, and which caused the halving of the efficiency that can be and is obtained by proper fitting. What will be said now that it is learned that, when Mr. Newbigging, the Corporation Gas Engineer, takes the matter in hand for gas jointly with Mr. Pearce for electricity, they agree to report that 13,500 yards of main thoroughfare shall be lighted by high-pressure gas-lamps and 11,835 yards by electric arcs or metallic filament lamps—consideration having been given, in deciding the parts allocated to electric lighting, to the presence in the thoroughfares of cables, which were some time since specially laid for public lighting purposes.

After all that has been said as to the illumination tests by Messrs. Jacques Abady and Haydn Harrison and Mr. Pearce and members of his staff, and the painful amount of wrestling that Mr. Pearce has had in trying to eliminate the defects for street-lighting purposes of the flame arc lamps as supplied to him, by the process of (as we witnessed the result) accentuating more annoying defects, the result of his collaboration with Mr. Newbigging is very satisfactory. The new Lighting Committee (which is a composite body, comprising five members of the Gas Committee, five of the Electricity Committee, and five Councillors who are not identified with either body) have endorsed the recommendation of their two Engineers. If the Committee had thought that all that has been electrically extracted for electrical consumption from the street-lighting experiments was incontestable, and required no discounting, they would have wanted to know why electricity was taking second place to high-pressure gas in the extent of the thoroughfares to be lighted. It is noticeable that metallic filament lamps are mentioned as a possible alternative to the flame arc lamps

—in part if not the whole distance; and we shall not be surprised to find that the harsh flickering light of the flame arcs (as fitted by Mr. Pearce for the purpose of getting as high illumination tests as possible from the trial lamps) will be toned-down somewhat. If he studies the public interests, Mr. Pearce will partly retrace his steps—by being content with a smaller candle power at the source, and with a modification of the angles of maximum ray distribution, by giving a little more opacity to the outer globes than is the case with those which he slightly etched at the bottom, and hung in Princess Street, to the inconvenience of the eyes of pedestrians and those responsible for vehicular traffic.

Gaseous Heating.

THE members of the Yorkshire Junior Gas Association on Saturday had a paper presented to them on the subject of "Gaseous Heating," by an author who, while not guilty of hiding his light under a bushel, has good and sufficient reasons for not disclosing his identity; and his desire for anonymity has to be respected. However, the wish to preserve anonymity is not due to the fact that he has introduced into his paper any matters of a highly polemical or heretical nature; on the contrary, in nearly all respects, he leads the members from elementary facts relating to combustion to the more complex actions and reactions that occur under different conditions in connection therewith, onward to actual applications. We can recommend the author as a safe guide to all students of the subject—for the paper forms a sort of text-book in miniature, and shows, in brief, what must be sought for in the provision of gas for, and in its application to, heating; and it supplies many valuable hints gathered from actual personal experience of gas producers and furnaces of various kinds. In his work, there is no subject that should have greater study bestowed upon it by the technical gas official than that of gaseous combustion and heating; for, at the very root of his manufacturing processes, working economy and effective results in heating and manufacture depend upon the correctness of the gases produced for heating the retort-settings, and of the manner of their handling and application. And, as the author remarks, the same knowledge is required in securing the proper utilization of the staple product of gas-works. Gaseous combustion and heating therefore come in all along the line between the termini of a gas engineer's operations. The production of heat by combustion and flame is a natural method; and therefore those who deal in the best and most controllable source of heat should know well as to the principles and energy changes involved in its production and in the means of securing from it, under the diverse conditions of use, the highest possible thermal efficiency.

We have seen many dire results of the lack of knowledge of the subject, where possession of the knowledge would have been a positive protection against such results. Take, for example, the combustion chambers of our own retort-furnaces. The author of the paper mentions that he is convinced that many of the failures which have occurred in them are due more to faulty design than to inferior material being used. He is probably correct in this to-day, now that greater attention is being paid to the subject of the quality and resisting power of refractory materials. But there have also been failures of which we are cognizant, due to an utter lack of knowledge of essentials, and that lack of knowledge has, in conseqnence, produced heedlessness—and structural disaster. In the interests of economy, too, mere inspection of the chimney and the main flue ought not to be regarded as being a sufficient indication of good furnace conditions on any works nowadays, when control can be so easily effected by the facilities now afforded. But there again want of knowledge, and an absolute indifference to the gaining of the necessary knowledge, are the causes of many of the high fuel accounts to be seen in not a few places. The author referred to the subject of proper air and gas regulation to furnaces; but in this connection he altogether omitted to mention the question of the automatic regulation of the air supply to retort-furnaces. This is a matter that, in order to ascertain whether or not it would be practicable, has not received the consideration that it merits. The variations that exist in retort-furnaces as time progresses between their charging and recharging, and between the operations of clinkering, as well as the differences that are caused in chimney pull by variations of wind direction and velocity and other atmospheric conditions, seem to demand some automatic means of regulating the air supply, according to variable requirements, in place of the hand-work that now obtains. There are many forms of such devices for automatically regulating air supply to the furnaces of boilers, brick kilns, cupolas, and other heating arrangements in industry. But in view of the importance of uniform heating, and of the fuel account in connection with retort-settings (especially, in the latter regard, with a good market for coke), it is a little surprising that this question of automatic air regulation in the case of retort-furnaces has not been seriously taken up in the gas industry. In no place should it be possible for a higher degree of gaseous heating efficiency and economy to obtain than on a gas-works. There, if anywhere, the means of producing the heating gases, the means of transferring the heat of combustion of the gases to where it is wanted, the means of recovering as much as possible of the waste heat, and the means of preventing wasteful dissipation of heat should be of the very best. Studies such as the one before us help to that end.

Again we are brought face to face with the application of the staple commodity of gas undertakings to industrial heating. This part of the paper is as equally useful as the other to students of the subject of gaseous heating; but there is nothing to be gained by a short comment upon the large area of the subject presented in the communication. The author of the paper is a pronounced believer in high-pressure gas for high-temperature furnaces; and that is the side of the fence on which most workers drop after they have had an opportunity of scientifically investigating the relative advantages and disadvantages, and the relative efficiency constancy, of high-pressure gas with air at atmospheric pressure, and high-pressure air with gas at district pressure. But a high temperature efficiency in furnaces is not to be obtained by the mere utilization of high-pressure gas; it has to be properly applied, or else it will fall short of what is expected of it.

The paper is an excellent and useful one. It is somewhat long for a "paper;" but the technical territory is large, and the information is sound. The anonymous friend of the Yorkshire Juniors, as of all others who find the paper useful, deserves their best thanks—the more so as no personal honour is obtained by the writer (owing to his anonymity) for the labour he has bestowed upon the communication.

The Gas Industry and Electricity Supply.

A TIMELY, and indeed valuable, contribution on this subject was made last Saturday, by Mr. J. W. Napier, of Alloa, to the Scottish Junior Gas Association (Western District); the value reposing in the facts that the author of the paper was dealing with what is for a large number of gas engineers virgin soil, and was doing so from his own personal experience. The "JOURNAL" has lately been devoting some amount of attention to the policy of gas undertakings, in suitable districts, embarking on electricity supply, and for much the same reasons that Mr. Napier advances in his paper—that there are people who, regardless of cost, will have electricity for lighting, that for certain purposes it has special convenience, that for scattered driving in works the transmission of energy by wire to local motors is also a convenience, and that in towns in which the field for trading is not large, there is economy for both the gas and electricity stations, and for the consumers of either commodity, in the gas-works being constituted the central station for the supply of light, heat, and power. In respect both of practicability and policy as a business proposition, Mr. Napier makes out a good case for the alliance of the two supplies in a town such as the one he represents; and he does so from his own experience—both he and the light, heat, and power users in the town being perfectly comfortable with their conditions under the joint running of the two supplies. In fact, we think this paper will do much towards silencing those electrical critics who think it impossible for a gas management to hold the scales fairly between the two supplies, or to work economically. The paper shows an excellent example to the contrary, there are other examples before us, and they are being annually supplemented by new developments.

It is perfectly obvious that the running of the two concerns together, in towns that are favourable, must produce economy, where division would produce waste. Supposing Alloa had an electricity station run quite independently of the gas-works (many gas-works themselves provide custom for the driving of travelling, retort charging and discharging

machinery, and other isolated plant), it would not have obtained such a cheap site, such cheap fuel, the convenience of extra assistance at hand when required, a saving in cost of buildings, and the economy of a management and staff common to both departments. Regarding the last-named point, Mr. Napier's observation, from the standpoint of his personal experience, is that those who are electrical engineers and nothing else put too much engineering into their work, and too little commercial knowledge. There are men now in the electrical industry, with a *penchant* for criticizing their fellows, who would give whole-hearted support to this diagnosis of the cause of certain troubles from which the electricity industry has suffered, and is suffering. Relating to the same point is this, that had an electrical engineer been at the head of the Alloa electricity supply station, he would have gone contrary to the interests of the undertaking, as do the majority of his professional colleagues, through a bias against all things that use or depend upon gas, however that gas is produced; and he would have equipped his station either with steam plant or a Diesel oil-engine, with the consequence that to-day he would have had heavier fuel costs, besides, with the latter, greater all-round expenses on the engine and accessories compared with properly installed gas-driven plant. There are few towns of the size of Alloa that can boast of a gas supply for ordinary purposes at 2s. 1d. per 1000 cubic feet for lighting, with slot consumers supplied at 2s. 5d., and power users at from 1s. 10d. to 1s. 4d.; and electricity consumers at 4d. per unit for lighting, and from 2d. to 0·9d. per unit for power, according to quantity. This is an answer to those electricians who assume that capital expended under gas management for electricity supply would be allowed to lie practically dead, and the gas undertaking have to bear the charges, and that electricity consumers would not get fair play. There are many electricity undertakings doing a business far larger than that at Alloa, which are not serving their patrons so well in the matter of price.

We can go farther, and ask whether there is to-day a public electricity supply station of the same size, which is being run independent of a gas-works, and under the management of an electrical engineer, that is generating electrical energy at a lower cost than is being done at the station under Mr. Napier's charge. He is generating by means of gas-engines, with suction producer plant fed by his own gas-works coke, with the town gas as a stand-by. There is a large security in this for electricity customers. Gas-engines for use with dynamos have been brought by the makers to a high state of mechanical perfection and smooth running; and the fact that the gas-works provide the fuel for the producers, and town gas when the producers call for cleaning or repair, makes the plant largely independent of outside fuel sources. Mr. Napier does not say at what price he charges out his gas coke for the producers. But he will cause the engineers of some of the imposing electricity supply stations to rub their eyes when they read of fuel, in his circumstances, costing him only 0·207d. per unit, or an average of (say) 0·25d.; also when they read of station costs—including fuel, wages, water, stores, and repairs—working out to only 0·721d. per unit (more than half of which represents wages) on the amount of business done. Such figures as these will rather confound those electrical engineers who think that good working and commercial success in electricity supply cannot come out of the gas industry. Parliament thinks otherwise; and so Parliament is in agreement with Mr. Napier that, under certain conditions (and those conditions seem to broaden instead of narrowing the further the investigation of the subject is carried), electricity supply by a gas undertaking is a good business proposition, and there is financial success in it.

Consulting Engineers—and Others.

The report of the Association of Consulting Engineers is an interesting document, if a somewhat slender one in the matter of the character of the material composing it. The original intentions of the promoters of the Association were to form an exclusive body for consulting engineers, to work for membership of the Association becoming recognized as a sort of testimonial of professional qualification, and to try to keep at arm's length, in respect of consulting practice, men of high engineering experience and capacity who might happen to be holding official appointments. The Committee in their report now disclaim any design on the part of the members to arrogate to themselves any undue competence in the matter of expertness; but they do claim that, devoting themselves as they do to consulting work, this "naturally gives them more experience in their particular "branch." A large extent of argument could be founded on this submission, starting with the point as to the character and amount of practical, and (as one civil engineer has recently put it) "brain-stretching," experience the consulting engineer had before transferring his activities to the highest branch of his professional calling. Besides this, times change, constructional work changes, practices change; and, unless the consulting engineer has the gift, and is in the position, to keep himself well abreast of the changes ever occurring in the several directions, he must be at some disadvantage as compared with experts whose daily work brings them into close touch with these matters. There are consulting engineers whose training, personal abilities, and wide interests enable them to be *au courant* with all new development; but not all who practise as consulting engineers are in their persons and interests so fortunate.

The Association are now protesting against Government and municipal officers being allowed to take engagements as consulting engineers—a practice which, it is said, occupies a considerable amount of their time, and reduces their efficiency as public servants. The last part of this statement is rather an unfortunate one. It depends upon the character of the work whether or not their "efficiency" will be impaired by undertaking it. We can conceive circumstances where special knowledge on their part, exercised outside their official province, would be of supreme advantage to the public; and it would be a bad thing indeed for engineering efficiency if the exercise of special knowledge and ability was to be barred by the fact of official service. The bar might sometimes act to the detriment of public service, by men of special qualification refusing to accept such service. At the same time, we do not suggest an uncontrolled liberty. On all grounds far weightier argument than is found in the report of the Association would be needed by us before supporting the efforts to construct protecting works for the sole advantage of consultants. As a matter of fact, we are sceptical as to whether the formation of the Association, and the opportunity given for calling attention to such matters as these, through statements in the Committee's report, are altogether advantageous to consulting engineers. From the origin of the idea of forming the Association, it has been held in these columns that it is not in accord with the dignity and position of the consulting engineer that he should require an Association for the protection of his interests. A consulting engineer should need no other protection than that afforded by his own individuality. The consulting engineer of brilliant ability requires no other recommendation than that produced by himself through his work, nor does he need the palladium of any organization. By a mere glance at the list of members of the Association, it is found that our views are confirmed by the absence of the names of most of those who stand at the very head of consulting engineering. Without their names on the roll of the Association, membership of it is not of particular account; but the dignity of those leaders and their position will prevent them becoming members. Under the circumstances, non-membership of the Association stands for a guarantee that those consulting engineers who are outside it do not regard themselves as in need of any mutual protection society.

The Committee of the Association have found for its formation a new *raison d'être*. One immediate reason, they say, for the establishment of the Association was the loss and expense caused to manufacturing and contracting firms, and indirectly to the public, through the waste occasioned by each firm tendering having to draw up its own scheme, and to provide detailed specifications for the work, instead of being able to tender to a definite specification drawn up by one independent expert. What the Association can do to alter this condition of things is not at all clear. As shown in the past, we are not in favour of the practice that has grown up, and are strongly of opinion that, where there is not a fully qualified engineer in charge of a works, a competent consulting or expert engineer should take the whole of an engineering scheme in hand from the first to the final stage. But if any impression is to be made in remedying an undesirable condition of things that has been allowed to grow up in the past, and to assume large proportions, it is not going to be done by an Association such as the one whose report is now under notice; for whatever steps are taken through an organized body of consulting engineers

will be treated as being not altogether disinterested, and, in the condition of the membership, any movement made by the Association to this end would not receive the imprimatur of the recognized heads of the consulting branch of the profession.

The point does not require enlarging on; but, while engaged in referring to it, it may be mentioned that we have received a private protest concerning the letter of "Civil "Engineer" that appeared in the "Correspondence" columns of our last issue. In that letter, the writer remarked: "I do not think any firm of gas contractors have "anyone about them thoroughly trained in the higher "branches of mechanics. They work by 'rule-of-thumb' "to a large extent, and copying designs of work already "executed, and on the principle of development by trial." The protesting correspondent, who is a gas-engineering contractor, and whose work (we can testify from personal knowledge) is a monument to his skill in engineering design and construction carried on over a great many years, is obviously of opinion that "Civil Engineer" does an injustice to his own power of observation by the sweeping assertion compressed into the quoted sentences. But our engineering contractor correspondent refuses to allow his letter of protest to be published, as he is disinclined to be met by the charge of seeking a "cheap advertise-"ment." His letter, however, indicates that he is not in the least impressed by the amount of experience that "Civil "Engineer" has had of contracting firms other than those with whom he has personally come into contact, and that he is unjust in placing all contracting firms in the one category. In his letter, he also has a tilt in the opposite direction to that taken by "Civil Engineer;" and we may quote a few sentences. "During my long experience," he writes, "I have necessarily become pretty familiar with "the amount of scientific investigation and attention to "'mechanical principles' devoted to their designs by not a "few civil engineers of various grades in the gas world. I "also know the methods that I, as a contractor, have learned "to adopt in my own office; and all I can say is that my "experiences are very different from those professed by your "correspondent." One can put upon these words more meaning than is directly expressed. From what we read in another letter from a different correspondent, whose experience in a contractor's drawing-office, in an expert capacity, entitles his views to respect, it is plain that some of those who profess and call themselves consulting engineers have proved to him by their drawings that they are unworthy representatives of the highest branch of the engineering profession. What it all comes to is this, that there are consulting engineers and consulting engineers; there are contractors who are competent in engineering matters, and there are some who are not. Neither in the one case nor the other can they be placed in one category in point of ability and attainments. It is for those who require the services of the one or the other to make a wise selection.

In this connection, we ask once more whether, in the interests of consulting engineers, the Association whose report invited our first comments is a wise creation. We have the right to think that it is not, and that, through the division it creates, it will do more harm than good. In no way does it add to the dignity of the specialist branch of the profession; and it can never be representative while those most eminent in the profession stand aloof, and see no need for its existence.

Threatened Higher Gas-Coal Prices.

If we have given proper interpretation to correspondence that has appeared in our columns from the side of the coalowners, it is the law of supply and demand that regulates the prices of gas coal, and there is no combination among the colliery owners that settles what contract prices are to be. It has been seen by experience that the law of supply and demand works very peculiarly so far as gas-coal prices are concerned, and that it is abused, if not by combinations, by agreements (which come to very much the same thing) as to what movement contract prices shall make, and these agreements are sometimes made long before the exact operation of that useful excuse the law of supply and demand can possibly be known. The "Coal and Iron Trades Review" has before been found very reliable in presaging movements of coal prices; and it now notices (as will be seen in another column) a threatened increase of price for the coming contract season of about 1s. on last year's figures, or 3s. 6d. or so on the prices of two years ago. New excuses for this increase have to be found; the old ones cannot serve for ever. One of those now put forward is that the gas industry is robbing the coalowners through gas cooking and heating of coal business for domestic purposes. We have not observed any shrinkage in the home consumption of coal; and the more gas the industry sells for this purpose, the more coal it will require from the coalowners, and the more the country generally will be benefited. Gas cooking has been a thing of many years' growth; gas heating has only touched the fringe of domestic heating; the population has grown, and the colliery owners are enjoying the fruits of the increase, and are robbing the gas industry of any fair share in that enjoyment. But there must be some reason for sweating the gas industry; and so any reason, however absurd and weak, is found to be good enough to serve as an excuse. The colliery owners also see that the gas residual markets (which are always a source of uncertainty) have been maintaining their prices in the past year; and there again they deny that gas consumers should participate in any benefit, or the gas shareholder under his rigorously restricted dividend should be allowed to secure some small increment. The colliery people want to take all the benefit; and their greed is simply intensifying the unfriendly feeling that their own actions have created (notwithstanding the efforts of their mouthpieces) among one of their best and most regular sets of customers. Perhaps the largest gas-coal buyers can do something, by shifting their contracts, towards helping to break down the unreasonable agreements from which the gas industry is now suffering, and which are impediments to the progress of gas supply and use.

The Polytechnic Examinations.

In another part of to-day's issue will be found the questions in "Gas Engineering" and "Gas Manufacture" set by the Polytechnic Examiner (Mr. Alwyne Meade, Assoc.M.Inst.C.E.) during the past week to the students in this subject. In the matter of training students in the theory and practice of gas making, the Polytechnic have spared no pains in affording them every opportunity of gaining thorough insight into the chemical, engineering, and commercial sides of the question. In addition to the general "Gas Engineering" lectures (held weekly for both grades), classes have been instituted for the separate study of gas-works chemistry, and also in applied engineering work, such as has to be dealt with in designing gas-works structures and plant. Moreover, in conjunction with the last-named classes the students have the privilege of carrying out practical experiments in the newly-equipped laboratory, where gas-engine trials are run, and materials of construction tested. A glance through the examination questions gives some indication of the wideness of knowledge expected; and the purely "chemical" student can hope for no more success than he who is acquainted with the engineering branches alone. With the view of adding interest to the examination, as well as to promote competition among the students, the Polytechnic now award (in each grade) a special medal to the student gaining the highest marks. Furthermore, certificates of proficiency are given to those who show exceptional promise. It is hoped that before long certificates will be awarded to all students who gain a percentage of the marks such as would be sufficient for a pass in the City and Guilds of London examinations. Much is heard now-a-days of the decline in attendance at evening classes. The infection, however, does not seem to have spread to the Polytechnic "Gas Engineering" lectures, at which, we are pleased to learn, the attendance for the past session constitutes a record.

The Exploitation of Del Monte.

The Company—Oil and Carbon Products, Limited—formed to exploit this system have been strangely silent during the week succeeding the expensive one that the promoters had in trying to get from the public the capital that it was thought requisite to raise for the purpose. A line has appeared in the sources of financial intelligence saying that letters of allotment have been posted, but nothing has been said, so far as we have seen, as to letters of regret being necessary for enthusiasts who had taken the prospectus and estimates as presenting to them the truth, the whole truth, and nothing but the truth, and had over-subscribed the capital. This seems to indicate that the promoters have not obtained all they wanted. Another significant thing is that the "Motor," which has done a large part in giving publicity to the

process in the motor car world, seems, in its last issue, to have begun a little side movement from the position that it formerly occupied in connection with the matter. We rather think it will be found (though there is no definite information yet to hand) that the public have not taken the process at the same valuation as was conferred on it by the highly toned terms of the prospectus and financial estimates, which were exactly the reverse of the moderate computations of Mr. W. J. A. Butterfield as a result of his investigation on behalf of the "Westminster Gazette." If our surmise is correct, that the promoters have suffered disappointment, they and the underwriters can now enjoy, by finding the balance of the money themselves, the riches of the gold mine which the prospectus pictured as reposing in the Del Monte system.

Ill-Advised Proceedings by Skegness Gas Consumers.

Readers of the "JOURNAL" will probably remember that there has been considerable dissatisfaction among the gas consumers of Skegness with the quality and price of gas. Early in the year, the Gas Company had to answer, at the Spilsby Police Court, a summons taken out by the Skegness Urban District Council in respect of the first cause of complaint; and the result was a lamentable failure—the case being dismissed. A number of ratepaying gas consumers who applied to the Lindsey Quarter Sessions at Lincoln last Friday for an order calling upon the Company to reduce their price have not come off better than the Local Authority. As shown by the account of the proceedings which appears elsewhere, they went to the Court armed with the report of an accountant who had examined the Company's accounts for 1911, and had made the discovery that four items, amounting to £417, had been transferred from capital to revenue, with the result that the profit had been reduced by this amount. If this transfer had not been made, it was submitted that there would have been a sum of about £760 available for the object for which the petitioners were contending.

A Weak Point in the Attack.

The applicants seemed to have a good case until the Chairman of the Bench asked their leading Counsel how he was going to get over the passage contained in the section of the Act under which his clients were proceeding which made it a condition precedent to the issuing of an order by the Court that the applicants should show that the company concerned had not only paid a dividend at the prescribed rate, but also had a reserve fund of the specified amount properly invested. With the latter portion of the condition, Counsel frankly acknowledged that he was unable to comply. The result was that the Bench came to the conclusion that there was no sufficient reason for the petition being presented; and they ordered the petitioners to pay to the Company the costs of the proceedings. In commenting upon the earlier litigation in which the Company were concerned, we remarked that it was a pity that, before any action was taken against them, there was not a full investigation, "to ascertain whether there was any flaw in the case by which it was sought to bring the Company to book." The words are equally applicable now. It seems scarcely credible that the point to which the Chairman called attention should have been overlooked or disregarded by the petitioners' advisers, and the two Counsel "learned in the law" briefed to support their case.

PERSONAL.

Mr. ARTHUR VALON, who has been an Associate Member of the Institution of Civil Engineers since the session of 1897, has been elected a Member.

Mr. J. SUTHERLAND, of Galashiels, who was formerly Gas Manager at Earlston, has been appointed to the vacancy at the Eyemouth (N.B.) Gas-Works.

We learn from the Chairman of the Weston-super-Mare Gas Company (Mr. J. E. Norman) that Mr. PERCY E. CULLING has resigned his position as Secretary, and that his connection with the Company has ended.

At a meeting of the Directors of the Penicuik Gas Company, Mr. J. RICHMOND was appointed Gas Manager in place of Mr. Williamson, transferred to Forres. Mr. Richmond commenced his career at the Whitburn Gas-Works, passing thence to Dunbar, where he was Gas Manager until 1898. He then was appointed to take charge of the Kilkenny Gas-Works. From there he obtained the appointment of Manager of the Maranhao Gas-Works, Brazil, which he left in 1911, owing to the ill-health of Mrs. Richmond. He obtained subsequently the post of Manager of the Navan Gas-Works, in Ireland, which he is leaving now to take charge of the Penicuik Gas-Works.

OBITUARY.

THOMAS COATES.

WITH much regret, we have to record the death last Friday, after a few weeks' illness, at Benwell, Darlington, of Mr. Thomas Coates, the Managing-Director of the Whessoe Foundry Company. For many years, Mr. Coates had been well known in gas and general engineering circles—especially in the North-East of England; and he was very highly esteemed and respected in Darlington, where he had lived and worked for the last twenty-one years.

He was born in 1842, and was educated at Newcastle-upon-Tyne, where his engineering training was begun under Mr. Armstrong (as the first Lord Armstrong then was) at the Elswick works. It is of interest to note that this was about the time of the introduction and adoption of the Armstrong gun; and Mr. Coates assisted in the works in finishing the first of these famous weapons. He remained in the Elswick works and offices for fifteen years, when he was appointed as Manager of Messrs. John Abbot and Co., of Gateshead. After twelve years in this position, his health compelled him to leave the North; and for four years he was the General Manager of Messrs. Appleby Bros., who were then making cranes and plant for the carrying out of the Panama Canal.

Mr. Coates's first direct connection with the gas industry followed as Manager of Messrs. R. Dempster and Sons, of Elland. Notwithstanding recurrent ill-health, Mr. Coates, about the beginning of 1892, decided to take over the old-established business of the Whessoe Foundry Company, of Darlington, which, by his determined efforts, sound engineering knowledge, and ripe experience, he developed from a comparatively small concern, employing some eighty men, into a large and successful undertaking with ten times the number of employees. Though his firm has constructed some notable gas plant, Mr. Coates extended his activities into other branches of engineering, and carried out works in many parts of the world. For some time past, he had relinquished the active management of the Company he had built up, to his two elder sons, Mr. Alfred T. Coates and Mr. Henry Coates, who, as Directors, will carry it on. A third son, Mr. Frank Coates, is an oil engineer in the East.

Mr. Thomas Coates was elected an Associate Member of the Institution of Civil Engineers in 1885, and at one time frequently attended the meetings of the North of England Gas Managers' Association. He was a freemason; and his private philanthropy was as generous as it was unobtrusive. He leaves a widow and a family.

The funeral took place at Darlington yesterday (Monday).

Mr. C. E. BRACKENBURY has kindly forwarded the following appreciation:—

"As a former engineering pupil of Mr. Thomas Coates, I feel that I should like to be permitted briefly to express my sense of personal loss in his death, and to mark my deep appreciation of my indebtedness to him for his instruction, guidance, and help. These he was always ready and willing to give; and the tie of master and pupil that began over twenty years ago continued and ripened into one of friendship and dutiful affection towards him. Mr. Coates was a fine type of the Tyneside gentleman; large-hearted and broad-minded; full of benevolence and quiet charity. His conversation was always interesting and helpful, leaving one with the feeling that here was a good man and true. He had the determined and fighting qualities of his race—'one who never turned his back, but marched breast forward.' Combined with this strength was an optimistic spirit which enabled him, in the face of not infrequent illnesses, to confront obstacles and overcome them. Withal he was always bright and cheering; and it is because of this memory that I am grateful to him, not only for his lessons in engineering, but, more important still, for his lessons in life."

The death took place at Illogan, Redruth, last Friday week, at the age of eighty-seven, of Mr. JAMES TANGYE, one of the founders of the firm of Tangyes Limited, Cornwall Works, Smethwick. Mr. James Tangye was one of five brothers, of whom the late Sir Richard Tangye was the chief, who established the Cornwall Works. He retired from business some years ago, and lived at his birthplace in Cornwall.

News has just reached us of the death, on the 10th of February, at Wellington (N.Z.), of Mr. WALTER WILLIAM MARTIN, who for a number of years was Engineer and Chief Draughtsman with Messrs. C. & W. Walker, whose service he left about six years ago to commence practice as a consulting engineer in New Zealand. Deceased, who was well known to a large number of gas engineers and managers, was in his sixty-first year.

NOTES FROM WESTMINSTER.

THE passing from the last session to the present one has been so promptly effected that those whose work takes them to the legislative chambers of Westminster can hardly realize that there is any disconnection between the one session and the other. The parliamentary machinery is being run too hard; and there are incipient signs of exhaustion and rebellion on the part of the human portion of the mechanism. However, we are in the new session; and there has been no loss of time in hurrying up Private Bill work. The preliminaries have been dealt with with creditable smartness, and without any particular hitch in connection with any of the Bills in which "JOURNAL" readers are concerned. As the view unfolds itself to those who closely watch the progress of gas and water measures, the magnitude of gas contest this session gradually shrinks to insignificant proportions. Several Bills are now unopposed; negotiations are proceeding in regard to others; and some have made, thus early, considerable parliamentary headway. A Commons Select Committee was the first to set to work; and last week some Lords Committees were busy. But there has been a comparative lack of interest in the proceedings, for most of the matters have been merely of local importance. The chemical manufacturers have been effectually silenced by the report of the Joint Committee of both Houses of Parliament; and so there is now peace in that direction. A few points of special interest that have emanated so far from the work in the Committee rooms are noticed in succeeding paragraphs. Here it may be mentioned that the Harrow Gas Company's Bill is going through the first House without any hostile action on the part of any of the local authorities. An exemplary agreement has removed opposition to the Slough Gas Company's Bill. It is to the effect that the extra 3d. per 1000 cubic feet that they are allowed to charge for gas in the rural districts is to cease when the revenue from these parts equals 10 per cent. on the capital outlay in connection with the main laying. A number of Provisional Orders have already passed (in a Confirmation Bill) the Unopposed Bills Committee of the Commons. If things continue as they have commenced in relation to Gas Bills, we shall have a short and sharp session's work. But there have been sessions in which the first experience has been similar to that of the present one; and then subsequently, in the matter of time the work has become somewhat scattered.

County Councils at Work.

County Councils, in connection with main-laying, are apparently this session going to pursue their old tactics of trying to get more out of promoters than the genera law allows. Several have lodged petitions; and they will bring pressure to bear on promoters to come to an agreement before the Bills reach Committees. It is to be hoped that no gas company or other authority will be forced into an agreement on onerous terms. Parliamentary committees, as a rule, are not disposed to give the county councils, in this respect, anything more than the general law allows, and to grant special provisions as to depth, steam-roller weights, or charges on a gas undertaking of expenses in moving pipes that are properly incidental to road improvements and structural alterations. From the point of view of general interests, it is not right for individual undertakings to concede extraordinary conditions to the road authorities. The Coventry Corporation Bill was the subject of attack by the Warwickshire County Council when before Mr. Hugh Law's Committee; but the Corporation stood out and supported their Engineer, Mr. Fletcher Stevenson. An agreement put an end to the opposition. But it only affected the limitation of the new area, the Corporation proposed to bring within its gas limits; and nothing beyond the ordinary was given in connection with main-laying in the new territory that is retained in the Bill. The Crowborough Gas Company, however, were less fortunate in the opposition of the East Sussex County Council, though Mr. Andrew Dougall, the Chairman of the Company, fought hard against the claim of the Council. In this case, however, it really only resolved itself into a question as to who should pay for the moving of the gas-mains in the event of the Council desiring to rebuild any one of the fifteen county bridges in the Company's area. They also asked that all mains should be laid at a depth of 2 ft. 6 in. But as this is the depth applying to the present mains in the district, Mr. Dougall saw no reason for combating this point. On the one affecting bridges, however, though the Company tried to get modifications, they were not successful.

The Gas Consumer and Electricity Supply.

An interesting point was raised on the Crowborough Bill [see report of proceedings in last week's issue] regarding the position of the customers for gas of an undertaking which also enters into the business of electricity supply. By the way, we are pleased to see that the Crowborough concern has been released from the crippling meshes of the net that had been drawn about it by unscrupulous promoters, and that now it is on the highway to success under the progressive chairmanship of Mr. Andrew Dougall, the Engineer and Manager of the Tunbridge Wells Gas Company. The Company are asking Parliament to confer upon them powers of electricity supply. There is no objection to this by Parliament or the Board of Trade; but the latter raised this point when the Bill was under consideration by Mr. Hugh Law's Committee: That under the Bill, the price of gas depending upon the dividends paid upon the whole of the Company's capital, whether employed for gas or electricity, the interests of the gas consumers would be jeopardized, through the retarding of reductions of price which might otherwise take place, if the dividends on the gas capital depended solely upon the gas profits—it being likely that for a time the capital invested in the electricity supply would be unremunerative. The Board therefore asked that the finances of the two undertakings should be kept distinct, and that the price to the gas consumers should be based solely upon the position of the gas undertaking. There is something in the contention of the Board looked at only from the narrow standpoint of immediate result, and not future possible result. It was submitted by the Company that the gas consumers would eventually benefit from any success achieved by the electricity concern. But there is another consideration. Supposing—and this is a very likely thing indeed to happen in a district of this kind—an electric lighting company started. The gas consumer would then be prejudiced by the retardation of the reduction of price by the splitting-up of the local business between the two concerns. Supposing something still worse—the taking up of electricity supply by the local authority—the gas consumer would then be injured not only by the reduction of the Gas Company's scope for business, but by the losses of the Council in connection with the electricity concern coming upon the gas consumers among the other ratepayers, and more heavily still upon the Company supplying them with gas. Of the three conditions, the gas consumer looks as though he would be more prejudiced by the last two than by the first one—that is, by the Gas Company having charge of the two services. The Board of Trade might be a little more logical in their actions. Up to the present, they have not considered the question of the prejudicial effect on the price of gas when local authorities have come to them for powers to speculatively put electricity in competition with private gas enterprise, with the electricity supply backed up by the ratepayers' money. Mr. Hugh Law's Committee gave the Crowborough Company the option of a standard price of 4s. 6d. instead of 5s., or the adoption of the proposal of the Board of Trade that the price of gas should vary according to the divisible profits on the gas undertaking only—the Committee feeling that the gas consumer is entitled to more protection than the Bill gave. The Company chose the lower standard price. If our electrical friends meditate over this matter, they will see that the raising of the point by the Board of Trade is not one over which they can rejoice. It indicates a feeling on the part of the Board, endorsed by the Parliamentary Committee, that there is something highly speculative about electricity supply, and yet it is less speculative in some districts when in the hands of the local gas company than it would be in the hands of a separate company or other authority.

Unsupplied Territory.

We have always held that—if, after a reasonable time has elapsed, and a gas company or gas-supplying local authority have within their parliamentary limits any area that they cannot profitably supply, and others desire to carry out the work—then the powers of the former should be repealed, and the latter should be allowed to undertake the service. It seems a bit monstrous that any undertaking, with unexercised parliamentary powers over any territory, should be permitted to play the part of the "dog in the manger." Parliament has set its face against this; and several cases have been before Committees of late sessions in which undeveloped territory of one gas undertaking has been transferred to another in the position to supply. The Model Clauses issued for the present session deal with the point, and in a way that may be considered absolutely fair. It is provided that, if after the expiration of five years from the passing of the Act the company or local authority have not laid down mains for the supply of gas in the described district, the local authority of that district, or any company or person, may apply for an Act or Provisional Order for the purpose of providing such a supply, and for the repeal of the existing parliamentary powers over the area. There ought to be no perpetual right in undeveloped gas-supply territory; and the time-limit that the new clause places on the development of extensions of area will be a good thing, because, though the company or authority possessing the rights during that period might not see their way to obtain 10 per cent of revenue on the capital (even with the right to an excess charge), a small local concern might be able to give the inhabitants a supply. The matter has been raised on the Titchfield Gas Company's Bill, in which the time-limit clause has been adopted. In this case the Company asked for an extension of area, and the repeal of powers possessed over part of the area by the Gosport Gas Company. The latter Company appear to have held the powers for 48 years; but the nearest point of their supply is still four miles distant, with only a 3-inch main. We are afraid the Gosport Company's case was not a very strong one in opposition to the request of the Titchfield Company; and it was a fair compromise that they arrived at with the promoters of the Bill, that, if within two months they should require the Titchfield Company to sell their undertaking, they should do so on the terms of the payment of the money actually expended by the Company, together with the sum of £450, and the costs of obtaining the powers now sought. Otherwise the Titchfield Company will remain in possession, with the extended area, subject to the time-limit, in the event of anyone else after the five years obtaining powers to supply.

Co-Partnership.

It was not a very graceful part that the Tynemouth Corporation took in offering opposition to the co-partnership clauses in the Tynemouth Gas Bill, and so causing the measure to come before Lord Balfour of Burleigh's Committee as a contested measure. Had the Corporation taken the trouble to investigate the actual position of the co-partnership system in the gas industry, the beneficent effects that it has had, and the protection that it affords the consumers by co-ordinating the interests of employers and employed, we can hardly think they would have shown such a lack of statesmanship as to have appeared at Westminster as antagonists to the scheme. With the large sanction that Parliament has given to co-partnership, and its knowledge of the benefits, individual and general, the Tynemouth Corporation could hardly have expected that Parliament would, at their request, refuse to allow the setting-up of a scheme at Tynemouth—not only for the benefit of the Company, but for that of the town and the consumers generally. There would not have been, so far as we can see, the slightest objection to the Corporation seeking for the submission of any scheme to the Board of Trade for their approval, if they had not preceded this request by one asking for the deletion of the co-partnership clauses, and raising various objections to the scheme in view of the Company being a maximum price and dividend one, and pointing to the possible injury to the gas consumers in connection with the price of gas. The face of Mr. William Hardie, the Engineer and Manager of the Company, reflected the confidence he felt that Lord Balfour and his colleagues would not deny the Company and their workers a scheme that has been largely approved by Parliament, and put forward as an example worthy of application, so far as was possible, to industry generally. Lord Balfour has had such a large experience of Private Bill legislation, and knows full well the consistent benefit that has followed the application of co-partnership in the gas industry, that he soon divulged his views; and the representatives of the Corporation saw that the best course to pursue was to say that the Corporation were not opposing the principle of co-partnership. This prompted Lord Balfour to remark that the issue between the parties seemed to be a very narrow one; and there was nothing easier than to say that there must be the formality of submitting a scheme to the Board of Trade before putting it into operation. As the Tynemouth Gas Company are likely to follow well-tested precedent in this matter, and which precedent Parliament has approved, the favourable decision of the Board of Trade on the matter may be taken as something positive. What the Corporation have gained by their singular action is not at all clear.

Extensions of Area and High Pressures.

This is a session in which the processes of extension of limits of supply, and the absorption of small gas undertakings, are features. The Grays and Tilbury Gas Company's scheme has succeeded in the House of Lords. The Company contemplate running their operations over a large additional area, purchasing various comparatively small gas concerns, centralizing the manufacture, and using high-pressure transmission for supplying the distant parts. The Port of London, however, have been the means of depriving one part of the proposed new area of a supply of gas. That is Canvey Island, where industrial development would have been assisted by a gas supply. But the Port Authority put their rights and dignity before any beneficial proposal for Canvey Island. To supply the island, the Company would have had to carry their mains across a causeway. The Port Authority wanted to have an absolute veto on the laying of the main; to prescribe the conditions under which it was to be laid; and if at any time they desired it to be removed, the Company were to comply. Rent was also sought. The Company regarded these conditions as an unsafe foundation for their main, and had visions of a possible disturbance of the permanence of supply to Canvey Island. So they cut the island right out of the scheme, rather than submit to any uncertainty. The proposal to transmit gas by means of high pressures to the farther parts of the new area raised a very old point. The Rochford Urban District Council asked for a testing-station in their area, on the ground that tests at the Company's works would not show the quality of the gas transmitted at high pressure at the other end of the main. Mr. Arthur Valon supported the claim; while Mr. G. Phelps and Mr. E. Herbert Stevenson opposed it. The Rochford Council did not get what they required. They need not be afraid of any depreciation of quality as the result of compression that will in any way affect the consumers. If the Company were supplying a gas unnecessarily rich in illuminating hydrocarbons, there might be some condensation through compression; but with the quality of gas they are supplying, the loss will be practically inappreciable, and will not in any way affect the consumers. The users of gas to-day want thermal value; and if there is a drop of 1 or even 2 or 3 per cent. in B.Th.U., who will be any the wiser, and whose pockets will be affected by such a difference? These requests for testing-stations in outer districts ought to be entirely out of fashion to-day.

South Staffordshire Water.

The South Staffordshire Water-Works Company supply an extensive area. The number of their consumers is constantly increasing; and the question of the provision of future supplies is a perennial one with their Engineer, Mr. H. Ashton Hill. The responsibility of the Company is very great; but their record is good for maintenance of quantity and quality of supply. The Bill that they have in Parliament mainly relates to new works and additional capital. The petitioners against the measure originally made a formidable showing; but they shrank down to one—Sutton Coldfield. This authority wanted to prevent the Company constructing works in their neighbourhood; and they also desired to purchase the part of the Company's system within the Sutton Coldfield administrative area. Apparently Earl Plymouth's Committee could not see that Sutton Coldfield could do better for the residents than the South Staffordshire Company—if as well. Nor did they see any reason for putting a ring-fence round Sutton Coldfield, within which the Company should not trespass in prosecuting water-procuring schemes for the benefit of their considerable area. The responsibilities and obligations of water-supply authorities are great; and Parliament has to protect them and their efforts to comply with these responsibilities and obligations.

THE PATENT OFFICE REPORT.

THAT there was no lack of work in the Patent Office during the year 1912, is evident from the thirtieth annual report of the Comptroller-General of Patents, Designs, and Trade Marks, which made its public appearance a few days ago, over the signature of Mr. W. Temple Franks.

Making first of all a comparison with immediately preceding years, it is seen that the number of applications for patents in the period under review (30,089) was well over that of 1911, though a little smaller than in 1910; the figures for these two years being respectively 29,353 and 30,388. In fact, the applications for 1912 were somewhat above the average of the last ten years. The applications accompanied by provisional specifications rose from 19,524 in 1911 to 19,825, which was an increase of 1·5 per cent.; while those accompanied by complete specifications rose from 9829 to 10,264, which was an increase of 4·4 per cent., and by far the highest number on record for any one year. As already remarked, this made the total number of applications 30,089, or an increase of 2·5 per cent. as compared with 1911. The complete specifications filed on previous provisional specifications fell from 8833 to 8589; so that the total number of complete specifications received was 18,853, compared with 18,662 the previous year, or an increase of 1 per cent. It is pointed out in the report that the tendency to file a complete rather than a provisional specification upon application becomes more marked every year; the proportion of complete to provisional specifications filed on application being now nearly 52 per cent., as compared with 30 per cent. in 1903. The total number of specifications (provisional and complete) received last year was 38,678, against 38,186 in 1911, which was an increase of 1·3 per cent. A just now exceedingly active section of the public will no doubt note with interest that the applications received from women inventors in the period dealt with in the report numbered only 636—or slightly over 2 per cent. of the total. Of all the applications, 18,649 were received from residents in England and Wales, 1128 from Scotland, and 378 from Ireland.

There was an increase in the number of applications received in 1912 from practically all parts of the United Kingdom, and also a small increase in those from Canada, India, and the West Indies. A considerable decrease is, on the other hand, shown in the applications from the Australian Commonwealth, New Zealand, and the South African Union. The foreign countries showing a decrease are Belgium, France, Germany, Hungary, Russia, and Sweden. The applications from Germany numbered 3169, compared with 3304 in 1911; from the United States, 2986, against 2670; and from France, 1097, against 1143. Out of 13,516 patents sealed upon the applications made in the year 1899, 509, or 3·7 per cent., were maintained for the full period of fourteen years. The number of patents which expired in 1912 was 15,492; and the total of new patents sealed was 15,814. Therefore the number of patents in force was increased during the year by 322.

It is always interesting to read through the section of the report which indicates the principal subjects to which inventors have devoted themselves during the twelve months reviewed. There are invariably some things which have proved specially popular with patentees—frequently connected with matters that have recently been more or less under the public eye. The motor-car and allied industries are, we are told, responsible for the most prominent group of inventions in 1912, particularly if applications dealing with internal combustion engines and with wheels for vehicles are included in this category. There were over 1200 inventions relating to internal combustion engines received during 1912, which was an increase of no less than 25 per cent. on the figures for the preceding year. Many applications were sent in, also, which dealt with the problem of converting heavy hydrocarbon oils into light oils of the nature of petrol, for use in these engines. There is welcome news in the fact that a considerable increase occurred in connection with inventions relating to exhaust-silencers. A crop of suggestions for the saving of life at sea is, of course, traceable to the "Titanic" disaster. Synthetic production of india-rubber continues to engage the attention of inventors.

Other popular subjects have naturally been appliances for the damping and affixing of stamps and the kinematograph.

As to the result of the examination of the complete specifications filed upon applications made in the year 1911, it is observed that 1188 of the specifications were reported as wholly anticipated, 10,193 as partly anticipated, and 5294 as not anticipated. Of those anticipated, 10,295 were amended without a hearing taking place, and 677 after a hearing and decision. In 302 cases, a reference to a previous specification was inserted. Under the provisions which empower the Comptroller to revoke a patent upon application made within two years from the date of the patent by any person who would have been entitled to oppose its grant, there were ten applications relating to eight patents. In four cases the patent was revoked, and in one an order was made requiring an amendment of the patentee's specification. One application was dismissed, another withdrawn, and one case has not yet been decided. The number of applications made for the revocation of patents worked exclusively or mainly outside the United Kingdom was three. In one of these cases the patent was revoked by consent, in another the application for revocation was withdrawn, and the remaining case is still pending. During the past year, five petitions for the extension of patents were lodged. Of these three were abandoned, and the other two are still undecided. There are at the present time only three patents in force which have been prolonged beyond the normal period of fourteen years.

The receipts from patents fees last year were £293,529, compared with £283,204 in 1911; from designs fees, £7891, against £7450; from trade marks fees, £19,359, against £15,990. The receipts from sales of publications amounted to £12,688—making the total receipts £333,467, as compared with £319,711 for the preceding year, or an increase of £13,756. The expenditure—which was £201,840, as compared with £204,980—shows a decrease of £3140.

FERTILIZERS, AN AID TO PROFITABLE FARMING.

An interesting book, bearing the above title, has been received from the Fertilizer Manufacturers' Association. The author is Mr. G. Campbell Arnott; and the amount of information given in it is considerable, yet the price is low—3d. in paper covers, and 1s. in cloth binding, exclusive, we take it, of postage. Naturally, coming from the Fertilizer Manufacturers' Association, the author argues in favour of farmers obtaining their fertilizers through the factories, in order that they may get the fertilizing ingredients properly mixed and in the right proportions for the various purposes. But altogether apart from this advice, the book is valuable for the information it contains.

As the author says, fertilizers must be used intelligently; but he goes on to say that, during recent years, numerous recommendations have been published which indicate that successful farming can only be carried on by the use of certain incomplete fertilizers—for example, by nitrogen in the form of sulphate of ammonia, nitrate of soda, or the newer forms derived from the air, by phosphates from basic slag, and so forth. It would be the height of folly for those who are developing the use of fertilizers of the kind to practise deception on those whose patronage they seek to obtain; for that sort of thing would be in the end disastrous to the objects in view. It can be claimed for the Sulphate of Ammonia Committee that they would not be guilty of such folly. The author proceeds to point out that demonstrations have proved that crops can be vastly increased by the judicious use of fertilizers; and that this increase means a very large profit on the outlay—in fact, nothing pays the farmer so well as his manure bill. Why no one fertilizer of itself is sufficient for plant growth is explained. Certain substances which are absolutely indispensable for perfect growth are always more or less deficient in an available form. These are phosphoric acid (the active principle in phosphates), nitrogen, potash, and sometimes lime. These must all be present in sufficient quantities for all crops. No excess of one can compensate for any deficiency of the other.

The author then explains how to supply these plant foods. He states how nitrogen stimulates growth, and how it can be detrimental when not properly balanced by phosphates and potash. Regarding nitrate of soda, he says: "The nitrogen being very soluble, and quickly available, it acts almost at once; but as it is very soluble in water, and held very loosely by the soil (especially light sandy soils), there is apt to be a considerable loss in wet seasons by drainage. It is advisable never to use it until the plants have their roots developed, so that they can assimilate it without delay. As a top dressing in the spring, it is of great value." Turning to the strongest competitor of nitrate of soda, the author remarks: "Sulphate of ammonia is not so rapid in its action as nitrate of soda, as it has partly to undergo a change in the soil, which is known as nitrification, before it can be entirely assimilated by the roots, to which end the presence of carbonate of lime in the soil is absolutely necessary. Pending this change, which is a gradual one, sulphate of ammonia has the advantage of not being readily washed out of the soil and lost in the drainage water." There is a little caution: "The continued use of either of these manures in large quantities is liable to have an injurious effect on the texture of the soil. Nitrate of soda in large quantities causes heavy land to be wet and sticky, the only remedy against which is the application of acid fertilizers. Sulphate of ammonia causes a loss of carbonate of lime, which must be replaced; otherwise the land becomes acid in course of time." This remedy is not a difficult one.

There is information regarding potash, phosphates, basic slag, superphosphate, lime, &c. Then we come to a chapter on complete fertilizers, which contain nitrogen, phosphate, and potash in varying proportions and degrees of availability "which long experience has proved to be most suitable for the requirements of individual crops, giving due consideration to the soil, climate, and rainfall." This is really one of the main objects of the book, to present the argument to farmers for adopting the complete fertilizers as prepared at the factories, rather than undertaking themselves the mixing and proportioning of the ingredients—the argument, of course, being that imperfectly mixed, badly conditioned preparations, are not so profitable as those that are perfectly mixed and properly proportioned, though the latter may cost more. Farmers, however, are obtaining a growing experience through practice, trial, and demonstration of what they can do on their own account. In a section in which the author shows that commercial valuations do not indicate agricultural value, he points out that the unit of nitrogen in sulphate of ammonia is generally the lowest in price; that in nitrate of soda costs somewhat more; while organic nitrogen in good available forms is still more costly. The error of being guided by the price per ton is emphasized in several ways. The second part of the book deals with the question of profits obtainable by the judicious use of suitable fertilizers.

Bearing in mind that the book is prepared in the interests of the Fertilizer Manufacturers' Association, it will be found interesting reading from the first page to the last, from which last page we may quote Mr. Arnott's final words: "The increase from the land is the primary and greatest source of wealth. It should be abundantly evident from the proofs which have been recorded that, notwithstanding all that has been written and said about the unprofitable conditions of farming, as well as the uncertainty of our seasons, when everything is taken into consideration, there is absolutely no investment to be obtained that will pay such handsome dividends as will money judiciously expended on suitable fertilizers, thus proving that the old Roman maxim, 'The more you give to a field, the more it returns to you,' holds as good to-day as when first promulgated."

BUILDING TRADES EXHIBITION.

The Building Trades Exhibition is now being held at Olympia; and, as usual, it will be found highly interesting. Buildings have an imposing part in gas-works equipment; and the design and character of these buildings are undergoing large change. There are many gas engineers who to-day wish that some of the buildings that their predecessors put up had not been constructed in manner that looks as though intended to stand until Doomsday; for, with the new developments of gas-works plant, different types of buildings are suitable and less space-absorbing in relation to the work done in them. The structural characteristics of buildings have been largely extended of late years; and there is choice now of construction and fitting that render very instructive such exhibitions as the one that will continue open at Olympia until the 26th inst. There one can see materials and types of construction of divers characters; and among them reinforced concrete work has prominence, together with the machinery that has been perfected for the proper mixing of concrete.

In connection with concrete work, we may specially call attention to the exhibit made by the Trussed Concrete Steel Company, Limited. It is in the form of a well-designed pavilion in the Doric or old Greek style, and constructed entirely of "Hy-rib." This material, which is one of the Kahn products, is a steel lath of unusual character in that it is broken up at intervals of $3\frac{1}{2}$ inches by longitudinal ribs some $\frac{3}{4}$ inch in height; and the stiffness thus afforded permits of its use as centering as well as reinforcement, and for walls, partitions, &c., eliminates the need for studs. Interesting applications of the use of "Hy-rib" are shown at the stand in floor slabs supported by both flat and curved "Hy-rib;" various stages of wall construction where it is used with supports; suspended ceilings at 4 feet centres as compared with the usual 12 or 18 inches; and centering for circular columns. In this latter form, it is an easy and convenient variant of the ordinary curved wooden centering which is apt to be so costly. Sample partition slabs are also shown; and generally the stand is admirably and tastefully arranged for the purpose of showing the manifold uses of "Hy-rib."

While devoting attention to building, examination should be made of the exhibit of the Patent Rapid Scaffold Tie Company, Limited. On the stand are shown the patent ties in different forms, and the uses to which they are put. These ties have been used on many important works, some of which are shown by photographs. To prove the rapidity with which the ties are made, interesting demonstrations are given, at various times during the day, by representatives of the firm.

But, generally, most of the exhibits are of interest to all who design, construct, and are responsible for building work of any description. There are not many exhibitors demonstrating how houses and other buildings should be lighted. Messrs. A. E. Podmore and Co. are showing types of their lamps for the lighting of

streets, shops, public buildings, warehouses, and factories, which lamps have been described in our columns from time to time. They are also demonstrating during the exhibition the system of semi-indirect lighting, using inverted gas-burners. Near by, the Holophane Company are making display of samples of their prismatic globes and reflectors; and the new "Residence" line of reflectors, with interior surfaces treated by a special "satin finish" process. These produce a very pleasing effect. There is also the "Uniflex" reflector, which is designed to give a uniform illumination over a plane surface with the aid of sources placed near one or more edges of the area illuminated. The "Stiletto" reflectors and reflector bowls are designed for use with inverted gas-burners or with electric metallic filament lamps. Worthy of special inspection are the new "Crystal" reflecting bowls, which are designed to produce efficient lighting, and to give the spectrum colours of the brilliant cut diamond. This, we are told, represents the most recent advance in the production of pressed glassware. Air-gas plants are strongly represented.

For ordinary domestic heating, coal and anthracite stoves predominate. There is very little to be seen in the way of gas-fires. The Carron Company have examples of their productions on view. The Altheat Company, Limited, are showing a new form of gas-fire. This is stated to be very economical, and to give a combination of radiant and convected heat, the latter of which is "never allowed to get to a temperature sufficiently high to burn up the air of the room." Further, "every particle of heat is utilized, and only the surplus 'cold' fumes escape up the chimney." The following particulars are extracted from information published by the Company:

Dr. Percy Wilde discovered that the fumes of a fire can be made to supply all the draught necessary for efficient combustion; that it is unnecessary to allow a current of cold air to pass through the fire; that the hot fumes can be made to circulate in a closed receiver until all their heat is abstracted, and then be projected into the chimney, or flue-pipe, with such force that they not only escape, but provide a very effective method of ventilation. This invention is based, not upon any elaborate mechanical appliance, but upon the utilization of well-known natural laws: (1) If we suddenly condense vapour inside a receiver, a vacuum is produced, and air will rush into any opening it may have. (2) If two volumes of vapour of unequal temperature meet one another, rapid condensation occurs. It is on the utilization of these two laws that the process in the "Altheat" stove is based. The hot fumes from the stove, at (say) 300° Fahr., are caused to enter a receiver, where they circulate in such a manner as to lose their heat by convection. They pass through dense vapour, and then re-ascend the flue-pipe, into which they were originally discharged where they meet the hot fumes as they enter the receiver, and so rapid condensation takes place. A vacuum is caused, and more fumes are drawn into the receiver; and as the process is continuous, a steady draught is produced, which makes no more demand upon the air of the room other than to take up sufficient to support combustion. At the same time, the fumes not only lose their heat, but much of the products of combustion are absorbed by the large quantity of moisture which is condensed. It was further discovered that, while the smallest opening in the upper part of the receiver, or radiator, destroyed the vacuum process, if a small waste pipe was fitted below the level of the fire, the cooled waste gases escaped with great force and produced a mechanical draught in the chimney, the value of which was at once recognized. By continuing the waste-pipe to the centre of a ventilator near the ceiling, not only were the waste gases discharged, but they carried with them a large volume of air from the top of the room, where ventilation is most needed. This method was at once adopted by the architect in building the new wing of the Lansdown Hospital, at Bath, and has proved a most perfect system of ventilation, as well as of heating.

The exhibit consists of two "Altheat" combined stoves and radiators, which are constructed for the Company by the Coalbrookdale Company, Limited. These are designed to take the place of an ordinary fire grate, which it conceals. In the centre is the gas-fire presenting some 80 square inches of radiant surface. The fuel used is asbestos cord, pressed into a mixture of asbestos and fire clay. It is a very cheerful looking fire. The ornamental receiver round the fire is constructed flush with the face of the latter. Into this the products of combustion pass; and this is the source of the convected heat, and the seat of condensation. It is pointed out that down-draught cannot cause the products of combustion to be driven back into the room, as the waste-pipe is at the base of the stove, and only opens into the radiator. By the way, a mica front is inserted in the canopy of the fire, and its construction is such that no products of combustion can escape into the room, the heat is deflected downwards, and one can see the whole of the fire wherever one is standing or sitting. The consumption of the fire is 10 to 12 cubic feet per hour. There are points about the stove which would be worth investigating; but a brief acquaintance with it at an exhibition would not warrant special mention of them here.

Houses, public establishments, and business premises must have hot water; and Mr. Thomas Potterton is showing various forms of his gas-heated boilers, some of the new types of which were specially noticed in our issue of the 1st inst. Means for gas and air adjustment are provided with the boilers; and the fronts of the new series of "Victor" boilers are, by slight modification, being made neater in appearance. Having so recently described the latest improvements and extension of types that Mr. Potterton has effected, we need not dwell upon the details on this occasion. The new "Sealed" oven cooker is also on view. Messrs. Ewart and Son, Limited, make an extensive display of their latest types of gas-geysers.

Messrs. George Waller and Son are exhibiting several examples of their productions appropriate to the exhibition, including a "Pinkney" gas-engine, valves, &c.

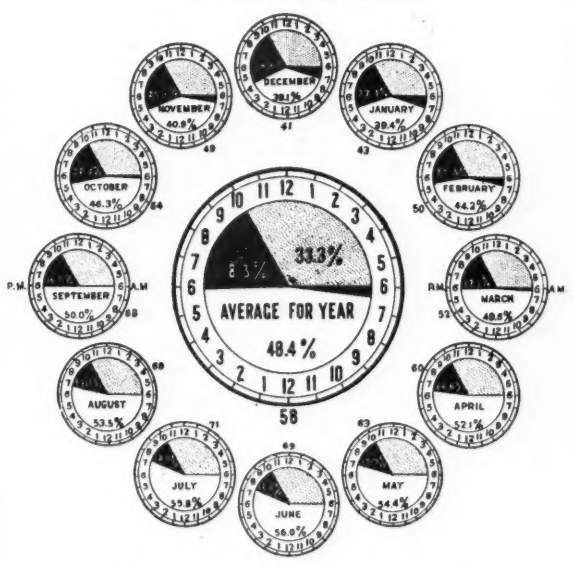
Looking round the exhibition, one is struck by the important industry that the use of tar for road making and surfacing has brought into being. Especially in the gallery, there are several exhibitors of such apparatus as travelling tar-boilers, and tar road-making materials.

In connection with water supplies, the Candy Filter Company, Limited, show plans, drawings, and photographs of different types of water-works filters—such as the automatic compressed air and oxidizing filter for the removal of iron, organic impurities, and peaty and other discoloration; the compound filter, with combined pre-filter and double scour, especially designed to deal with turbid and muddy waters, or waters that require chemical treatment prior to filtration; the De-Clor filter, which ensures the destruction of the *bacilli coli* and other bacteria; and the hydro-pneumatic injector for adding chemicals to water. Messrs. Ham, Baker, and Co., Limited, also call attention to various water-works requisites; Mr. E. T. Bowyer is showing Templeman's patent joints for water-stand pipes; and William Boby's water-softeners for treating public supplies and for industrial use are also on view, in both large and small sizes.

From this brief sketch it will be seen that the exhibition contains much of varied interest that must appeal to all engaged in the various branches of engineering.

LIGHT AND DARK FOR THE MONTH.

UNDER this title, the "American Gas Institute News" for April publishes a chart—here reproduced about one-third the size of the original—supplied by the Commonwealth Edison Company of Chicago, and which is as valuable and applicable to the gas as to the electric business. An adaptation of it to English conditions would be useful for printing on slips to accompany the quarter's gas bills.



Gas-Purifying Apparatus.—Messrs. H. W. Jacobs and H. H. Lanning, of Topeka, Kansas, have taken out a patent for the United States for gas-purifying apparatus. An abstract of the specification in the "Journal of the Society of Chemical Industry" furnishes the following particulars of the invention: A gas-washing apparatus comprising a receptacle having a detachable cover carrying a number of pipes dipping into the liquid in the receptacle, with rose nozzles at the lower ends through which the gas is injected in a finely-divided condition into the liquid. The wash water flows continuously through the receptacle, and is maintained at a constant level by an overflow discharge-pipe. The purified gas is withdrawn from a dome-shaped projection at the top of the cover. A gas-washing apparatus similar to the foregoing, but having a single inlet-pipe for the gas, with a large perforated distributor at the bottom, is fitted with a conical filter at the foot of the gas-discharge dome, so arranged that the accumulated foreign material separated from the gas is conveyed to the side of the filter, out of the path of the rising gas, and discharged into the washing water beneath.

ELECTRICITY SUPPLY MEMORANDA.

We are rather glad than otherwise that the subjects of electric heating and cooking are kept in a prominent place in the literature and rhetorical performances of the electricity supply industry.

Discontent with Design.

This makes things far more interesting; and the interest is expanded by the diversity of experience and opinion. "All is well in both directions" blatantly remarked (in effect) the "Electrical Times" the other week as it blew itself out to abnormal size. But then came a leader on the subject in the "Electrical Review," an article by "Element" in the same issue, and a recent discussion opened by Mr. T. Roles, of Bradford, at a meeting of the Yorkshire Section of the Institution of Electrical Engineers; and in them we find that there is much yet to be done before things in these respects can be said to be on the high road to a permanent success. The complaint appears to be very general that electric cooking appliances lack efficient design, and that they are subject to breakdown; and in connection with heating, it is the cost, the low heating power of electricity, and the low percentage of radiant heat that are arrayed against it. If the types of a number of different makers' electric-cookers are examined, the great variation in design is seen; and the philosophic "Electrical Review" thinks it a great pity that the makers should be working along different lines, as this means that a great deal of unnecessary trouble and expense is incurred. In development work, a good range of investigation and experiment produces new side lights that help to perfection. But the "Review", is in a great hurry. It advocates competent research into these matters, which process it tells an ignorant world, through giving expression to a scintillating thought, "is akin to that pursued by the breeders of animals, and horticultural experts." Of course, this process is a proper thing; the gas industry has practised it. It was not, however, in any violent hurry, and then not for the purpose of standardizing the line of development, but of eliminating defect, and pointing out proper structural principles.

Unreliability.

The article in the same issue by "Element" is partly spoilt by commencing with some puerilities as to noxious fumes, better appearance of meat, less shrinkage, &c.; but this same gentleman is disposed to agree that development and general adoption of electrical cooking must be slow, even if ideal apparatus is placed on the market—*plus* all the advantages the electric cooker is said to possess, to say nothing of its many disadvantages which stimulate thought, and give a greater flexibility to one's mode of expression. Regarding those commonplace arguments that are put forward in favour of the electric-cooker, though "Element" benevolently describes them as weighty, he does not consider they are sufficient to warrant the householder in discarding the use of the gas-cooker. There must be a greater reliability; there must be no breakdowns of supply or of apparatus; and there must be no electrical shocks through defective apparatus. The heating elements must have a good life; and something must be done to keep the hot-plates from getting dented and the bottoms of heating utensils from being knocked out of truth by heavy-handed servants. The cost and time occupied now in heating utensils on the important parts external to the oven (upon which parts the electric demonstrator does not like to expatiate too much) are quite enough as it is; but the destruction of complete electrical conductivity is fatal to result and patience. The article had better not be read by any electrician of pessimistic tendency, because it will only intensify his despondent spirits to be told direct that there is a lot of rubbishy electrical stuff on the market, and to have the impression conveyed to him that the remainder is open to suspicion. Some of the makers, knowing so well the weaknesses of their apparatus, find it necessary in the effort to establish some sort of a business in this line to give a five years' guarantee against breakdown. This is not so much a matter of enterprise on their part; it is a matter of sheer compulsion. "Element" agrees that electric cookery devices must be more expensive than gas appliances; but he pleads that there shall be no attempt to obtain cheapness by leaving out devices that tend to greater reliability.

Temperatures and Food Inspection.

Our friend seems to favour the electric-cooker that is constructed on the lines of the gas-cooker, with packed sides; some other electricians want to strike out a new line for electric-ovens. One great need of the electric-cooker is that the minimum of heat shall escape from it. The door ought not to be, but will be, opened; and thermometers should be inserted in the oven, in order to give information as to the temperature without having to open the door. In one form of oven, an inner glass door is provided, so that the cook may examine the food without having to open the door. Rather that is the intention. But what with steam and grease on the glass door, unless a strong search light is brought to bear upon it to assist the human vision (with a proper shield to protect the eyes of the user, and so satisfy the views of the Illuminating Engineering Society), we cannot quite see what will be the advantage of the inner glass door. Who thinks that the average cook will be satisfied with looking through a steam-clouded glass door? One genius has suggested that the temperatures of electric-ovens should be standardized for the cooking of all forms and quantities of food, and that tables should be compiled for ready reference by the electrical cooks. They will have to be voluminous tables; and we can see the commander-in-chief of the kitchen being bothered by them and the reading of thermometers in addition to bestowing gentle handling on the cooking utensils in order not to injure their pristine evenness. Precisely what good tables of temperatures would be, with temperatures definitely governed by switching arrangements, it is difficult to see. Electricians want the art of cooking reduced to a mechanical condition so as to suit the electrical method, and not the varied tastes of those for whom cooking is done.

Cost and Temperatures.

It looks very much as though in connection with electric cooking there may be much the same (though probably lessened) experience as with electric heating. A few electricity consumers may be persuaded by the importunate electrical canvasser to adopt cooking outfits; but the business of the gas suppliers will make the business of the electricity suppliers in the same line look insignificant in comparison—just as is the case in the heating branch. Some of those who do allow an electric-cooking outfit to be introduced to their premises keep a gas-oven in position as well; and the latter is found very useful, despite the frequent inspection of the former made by the electrical expert in order to try to obviate defects and difficulties. The Marylebone Electricity Department has probably worked harder and longer at this cooking business than any other electricity concern; and in the before-mentioned paper by Mr. Roles, it is stated that the Marylebone undertaking has now nearly 200 complete electric cooking outfits on hire by consumers. This does not afford much information. At Bradford (the scene of Mr. Roles' activity) there are 25 electric cooking-ovens in use. At York 24 cooking outfits have been installed, and out of these two have been returned already. However, Mr. Roles is of opinion that no great headway will be made by any supply undertaking working in an area where gas is supplied at 3s. per 1000 cubic feet or under, unless electrical energy is supplied for such purposes at a price not exceeding ½d. per unit. To this price Mr. Roles is not himself working, though he talks of the supply being metered at ½d. per unit. Before consumers can get energy at this figure, they have to pay annually a special charge of 15 per cent. per annum on the net rateable value of the premises. Some electricians have singular notions on the question of the relative costs of gas and electricity. The greater economy seen by the imaginative electrician of baking by the electric-oven (it is preferable for his comfort that the electricity consumer should not trouble his mind about anything else), is due to the supposed greater efficiency of the oven. According to one report of the discussion on Mr. Roles' paper, Dr. Pohl, of the Phœnix Dynamo Manufacturing Company, stated that, with gas at 2s. 5d. per 1000 cubic feet and electricity at ½d. per unit, the cost for cooking would be equal. Gas-ovens, he added, had not an efficiency of more than 60 per cent., while electric-cookers had an efficiency of from 80 to 90 per cent. The 60 per cent. efficiency for the gas-oven is a big concession by our electrical friends. We believe that the highly scientific, disinterested tests—tests carried out we assume with all the delicate, scientific paraphernalia necessary for the accurate measurement of heat efficiencies—of the peregrinating Mr. Grogan, of "Tricity" service, concedes to the gas-oven a heat efficiency of only 12 per cent. It is a phenomenon of no mean order that, in an enclosed space bounded on all sides, and with a small ventilating aperture at the top, the temperature derived from a source of heat such as gas should make such violent efforts to escape from confinement; and yet, on the other hand, the scientific Mr. Grogan himself gravely asserts that the temperature of the gas-oven is such that joints baked in it collapse in bulk and weight to an alarming degree. However, Dr. Pohl accords the gas-oven a 60 per cent. heat efficiency, and says the cost of cooking, with the price of gas at 2s. 5d. per 1000 cubic feet and of electricity at ½d. per unit, is equal. Let the Doctor take the heat units purchasable for ½d. with gas at 2s. 5d. and the heat units purchasable for ½d. with electricity; give to the gas-oven a 60 per cent. efficiency, and the electric-oven 80 to 90 per cent.; and then see where the equality comes in. One cannot take a common standard of efficiency for gas-ovens any more than for electric-ovens. The types vary in both. During the discussion of Mr. Roles' paper, Mr. W. N. Y. King, of Sheffield, stated that the price of gas there being only 1s. 3d. per 1000 cubic feet [the average price at which gas was supplied during 1912 was 1s. 1·83d.], made it practically impossible for electricity to compete in running cost.

Defects of the "Tricity" Outfit.

We have sympathy with the "Tricity" people. They have done a lot of pioneer work in the country in this matter of electric cooking, though their statements and their methods of carrying on their campaign have not always met with our unqualified approval. But people are beginning to find out that the "Tricity" design of outfit is not all that is requisite. Subject to the correction of any lapse of memory on our part, we think that it was Mr. Seabrook or Mr. Holmes, of Marylebone, who publicly stated that the biscuit-box form of construction of the "Tricity" cooker did not meet the demands of the kitchen.

The methods of servants cannot be converted to suit the design and structure of electric cooking outfits; the outfits must be constructed to meet the requirements and modes of the kitchen. There would have been a disastrous maintenance account for the gas industry if, under its hire and prepayment meter systems, it had adopted a flimsy form of oven, such as that with which the "Tricity" people are attempting to establish a permanent business. Mr. Roles, in his paper, says the "Tricity" outfit possesses a number of disadvantages. He points out that the flexible connections to the hot-plate on the top of the oven and the extension cooker are often found to be in the way; and, as is the case with all flexibles, faults develop where the wire is attached to the plug or to the plate. The plugs also after a time make bad contact owing to the pins losing their spring through constant use. When this happens, either the plug heats-up the fuses, or, as had been the case on a number of occasions, the contact is so bad as to prevent current passing to the hot-plate, with consequent loss of heat in the oven and spoiling of the food being cooked. Another great disadvantage which is found in connection with this outfit is its novelty of construction, which causes it to fail to appeal to the average cook, who is usually of a conservative disposition. Having been used to coal fires and gas ranges, the cook naturally prefers that an electric-cooker should be constructed somewhat on the same lines; and for this reason electric-ovens designed on somewhat similar lines to gas-stoves are now becoming the standard article provided for electric cooking purposes. There is another point. Ovens must be of a character that will suit all parts of the country. Mr. Roles expresses the opinion that most electric-ovens have been designed to suit London conditions, and have been made sufficiently large to cook a small joint and pastry. Such ovens will not suit Bradford, and many other parts, as one of the first requirements in the West Riding seems to be that the oven must be capable of baking bread, whereas in London it is unusual for bread baking to be carried on at home. Electric heating elements are usually placed round the sides of the ovens, but home bread makers and bakers require a bottom heat. At the same time that we have Mr. Roles making these criticisms of the "Tricity" outfit, there comes to hand a paper that Mr. W. H. Alabaster read on the subject of electric cooking before the Melbourne Science Congress. In this it is shown that, of a number of electric-cookers he has tested, he finds that the "Tricity" oven comes about midway in the list in respect of the watt-hours required for the oven—some other types being better, others worse. On the basis of consumption in respect of a unit of oven area, the "Tricity" again takes about a middle place.

Heating.

Last week in the window of the premises of the Electricity Publicity Committee in Tudor Street, E.C., the central feature was an announcement that there were a number of second-hand electric radiators of various types to be seen inside, and for sale. That is not altogether a good sign to be exhibited in the central depôt of the people part of whose business it is to convince the public that there is nothing like electricity for heating purposes. The announcement will cause the passing public to ruminate on the point as to whether all is true that is said in the literature of the Committee as to the virtues that cluster about electrical heating. If it were all true, there would be no second-hand electric radiators for sale. The conversion of the depôt into a second-hand shop is unbecoming of the dignity of the Committee. However, in the editorial article previously alluded to as having appeared in a recent issue of the "Electrical Review," the wisdom of the writer allows him to refer to the "cruder methods" of our competitors. Exactly what is covered by the term "cruder methods," he does not say. Does he mean that the larger percentage of radiant heat, and less percentage of convected heat obtained with the gas-fire than with the so-called electric radiator, is a cruder method? Or is it that the lower cost of heating a room of a given cubical capacity by gas-fires constitutes a "cruder method?" Or are the "cruder methods" summed up in the statement that they "involve the use of chimneys, at a considerable cost to the builder?" If this is the sole point, may we mention the obvious fact that all houses in existence have chimneys, and at present builders do not seem disposed to build them without? In fact, our hygienic friends tell us that chimneys are the most efficient ventilators that houses possess, for keeping the atmosphere in good condition at the living and breathing level. If it is desired to do without chimneys, the gas-fire will be content to perform its work with an inexpensive outlet tube, and still contribute to ventilation. We turn to Mr. Roles' paper, and find he gives a piece of unhealthy advice. He says that, if warmth is required intermittently, an electric radiator should be installed; if warmth is required in the shortest possible time, and the warmth is to be maintained afterwards, an electric convector should be used. Convected heat is not so healthy or so comfortable as radiant heat; it gives rise to headaches and so forth, and was the cause of the old and discarded form of gas-fire construction bringing gas heating into early disrepute. As to cost, in the discussion Mr. T. H. Churton stated that he had come to the conclusion that, using radiators and electricity at 1d. per unit, was rather an expensive mode of heating a room of any considerable dimensions. Mr. W. B. Woodhouse worked out from Mr. Roles' paper that to heat a house rated at £50 would involve a heating bill of £80. Mr. A. B. Mountain's experience of electric radiators agreed with that of Mr. Churton. Mr. H. Vesger considered electric raditors were excellent things for old people and babies when going to bed and getting up in the morning. Another speaker suggested that fresh air should be passed into a room through a hole in which a small electric-heater was placed; and so advised the drying of air, and one of the worst forms of heating. The modern gas-fire has given the electric radiator a nasty shock, apart from the questions of cost and indifferent and bad mode of heating of the latter. Experienced electrical men know this.

The Sense of Justice.

This particular human quality does not seem to be strongly marked among electrical people. It will be remembered that early in March a peculiar statement was made at the Eton Board of Guardians regarding the cost of lighting and heating at the Slough Workhouse—a statement that showed, as the matter was then unjustly presented, that since electricity had been installed and coal used for cooking, there had been a saving as compared with the former gas account. The Slough Electric Supply Company had the report reprinted and circulated; and we cannot think they did not know before they took this step that the report was grossly unfair to the local Gas Company. If they were not aware that it was so, they were soon afterwards in possession of the information, which put a totally different complexion on the matter. They know now, if they did not know before, that the bulk of the gas-burners the Guardians were using were old flat-flame ones and not incandescent ones, and that gas was being used indiscriminately for other purposes than lighting and cooking. They know, too, that the consumption of gas has increased extraordinarily the last few years. Knowing all this, have the Electric Supply Company taken any steps to correct the false impressions and information that they were instrumental in circulating? Not they. The "Electrical Times" and the "Electrician" have published the same figures, probably supplied to them by the Slough Electric Supply Company. The whole facts of the case were set out in our issue for March 11 (p. 660); and the "Electrician" did not publish the figures until April 4. Did the "Electrician" make any remarks putting the case of gas in the proper light, and showing the impropriety of the whole comparison? Not it. Although the "Electrical Times" has more than once had its attention drawn to the actual facts, it has ignored them, and left the figures in its pages as circulated by the Slough Company to mislead others. What is the result? The figures, without the explanation as to their full meaning, are being quoted in the provinces by electrical people as representing an actual comparison between modern gas lighting and cooking and heating and modern electric lighting and cooking by coal; whereas with gas there were 186 flat-flame burners in use and only 22 incandescent ones, a gas hot-plate, a large gas-oven, about half-a-dozen boiling-rings, and greenhouse heating. The consumption representedby these things is set against the cost of metallic filament lamps and a new coal kitchener! What sufficed in the way of gas consumption in 1908 was nearly doubled by 1911—the increase having been from 558,000 cubic feet to 1,077,700 cubic feet. No gas company can control the use of its commodity in a public institution any more than it can do in a private house. We do think this is a case in which our contemporaries might have put the facts in a true light, and not have shown a mean indifference to facts, and a preference for figures that misrepresented the whole position. Which one of our electrical contemporaries will have the courage to tell the truth of the matter, and at the same time protest against the distribution of misleading information?

Wide Tendering.

If there is one thing that comes next in uncertainty to breakdowns of the supply of electric current, and the electrical generation of fires, it is the amounts of tenders invited for electric wiring and fitting. This ought not to be a matter that should involve any great disparity between one tender and another. But it is not an uncommon thing to find that the top tender received for the wiring and fitting of an establishment may be three or four times more than the lowest tender on the list. That is what happened in connection with the wiring and fitting-up of the Lewisham Infirmary and Workhouse. There were seventeen tenders received. The top tender for the Infirmary was £1800, and for the Workhouse £1135; the bottom ones being respectively £479 and £449. The other fifteen tenders were scattered between these amounts in a curious fashion. We take it there was a specification issued for the work; and, if so, what possible justification is there for such a difference as over £1300 for fitting up the infirmary, or a difference of about £700 for fitting up the workhouse. Quality alone cannot be represented in the difference. If it were, then it would mean that the Guardians are proposing to sacrifice the highest attainable degree of safety and efficiency for something of a very inferior nature by accepting the lowest tenders. We do not think quality alone is the true explanation.

In the brief notice of the forthcoming meeting of the Eastern Counties Gas Managers' Association which appeared in the "JOURNAL" last week (p. 81), it was mentioned that papers would be read by Mr. T. Goulden and Mr. W. Orme. We learn from the circular issued by the Hon. Secretary and Treasurer (Mr. Joseph Davis, of Gravesend) that Mr. Goulden will give a description of a recent reconstruction of a retort-house at Beckton; and that Mr. Orme's paper will be on the subject of "Burners." The members will dine at the Lion Hotel in the evening.

THE NEW SCHIELESTRASSE GAS-WORKS, FRANKFORT-ON-MAIN.

Coal and Coke Handling Plant.

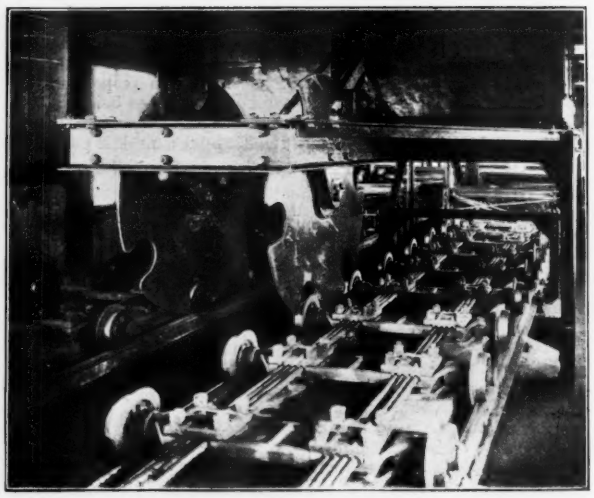
In the "Journal" for March 18 appeared a short general description of the new works of the Frankfort Gas Company. We are now able to give some further details of the coal and coke handling plant, translated from particulars kindly supplied by Mr. William Drory, the Engineer and Manager of the works.

General View of the Coal Yard.

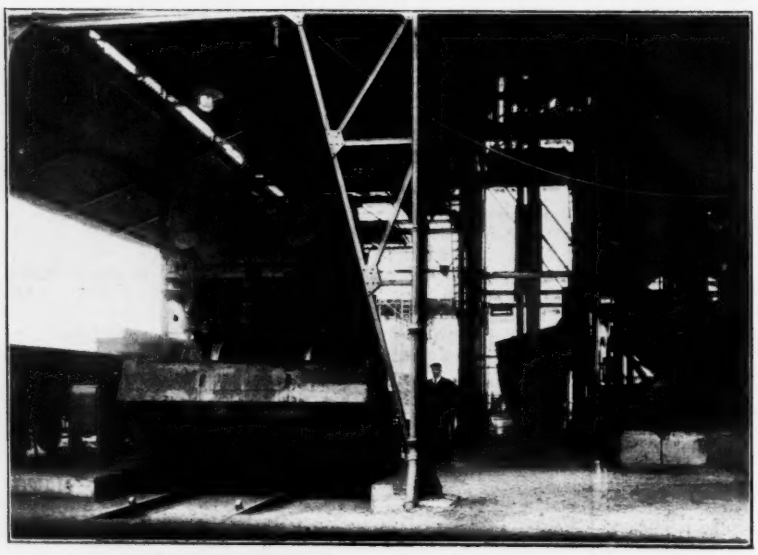
Coal-Handling Plant.

The position of the coal and coke stores in relation to the retort-house is so chosen that the distance to be traversed by the coal used and the coke produced is the shortest possible. The coal is stored in the open. The level of the coal-store is the same as that of the rail systems on the works, which is also the same as the whole working level and the railway siding.

The coal-handling plant is intended for unloading both railway trucks and river barges; but the complete arrangements for the latter have not yet been able to be finished, as the harbour, which is being made by the town authorities, is not yet ready. The plant is designed for two distinct operations. The coal can either be unloaded and taken by way of the breakers to the retort-house or direct to the store; or it can be taken from the store to the retort-house by way of the breakers. The plant for unloading barges later on will be fitted to work in conjunction with the present system without any changes. The spot chosen as most suitable for unloading the railway trucks was between the two proposed retort-houses (only one of which is as yet built), and at the southern end of them. In settling the capacity required of the coal-handling plant, the daily production of the retort-houses was naturally considered. The maximum make of one house is 125,000 cubic metres [about 4,412,000 cubic feet] which is considered safely covered by 360 metrical tons of coal, or 720 tons for the two houses. The yearly make is reckoned as 240 times the highest daily production; so a year's make of 60 million cubic metres is covered by 180,000 tons of coal. Counting on a regular supply for 250 working days, the plant had to be capable of dealing with about 720 tons daily. The store can take about a third of the annual coal consumption.



The Bradley Elevators, with Apparatus for Registering the Weight of Coal used.

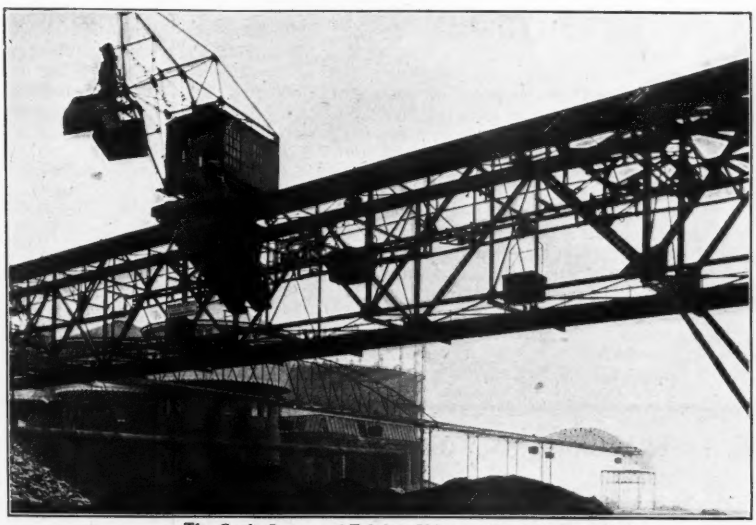


The Waggon Tipper in Action. On the right is the Coal Lift.

The operation of unloading trucks is carried out as follows: The train is pushed by the shunting engine over the weigh-bridge to the unloading station. Here the trucks are uncoupled and pushed singly by the train on to the tipper, which can deal with about six per hour. They are then drawn by a capstan to a traverser situated at the end of the line, and taken on to a second line. Practically all the trucks can be tipped as they come; but if any happen to arrive with the brake-shelter towards the tipper, they are shunted in the yard, turned round, and tipped separately afterwards. It also happens, though very rarely, that trucks are received, the ends of which will not open. These are pushed on to a second line near the tipper, and the coal unloaded by hand into the tipper pit by means of a shoot arranged at the side. The pit under the tipper is of ample dimensions. It has two side outlets at the bottom, which are opened and closed by means of circular slides, worked by small electro-motors in conjunction with two vertical lifts on the bucket principle. The tubs or buckets, which take 2½ tons each, are purposely made

very big, as the Saar coal often arrives in quite large pieces. The tubs are suspended freely, and brought on rollers under the ground to the pit outlets, which thereupon automatically open, and close again after a predetermined period.

The lifts are arranged with two stages. If the coal is to go straight to the retort-house, it is emptied, by simply setting a switch, into the bunkers at the first stage. Hence the coal passes by way of preliminary screens to the breakers and then to the retort-house. If it is to be taken to store, the lifts go to the second stage, and are there emptied likewise into a bunker. From this the coal is let by hand into the skips of the telpher railway (described later), which take the coal to the store. The lift works absolutely automatically, the weight of the tub being counterbalanced by an equal weight. The power used is a 21 H.P. motor which works in conjunction with the motor operating the closing slides of the coal pit. One lift is capable of raising from 60 to 90 tons per hour, according to the kind of coal. From the bunkers at the first stage the coal is shot over the preliminary screen into roller breakers, which break the pieces to a maximum size of about 2½ inches. The coal is raised from the breakers by two Bradley elevators of the usual type into bunkers at the top of the retort-house on the southern side; each elevator being able to deal with 60 tons per hour. In connection with them is an automatic weighing device, so that all coal passing into the house is first weighed. From the retort-house bunkers the coal is distributed to the small hoppers placed above the retorts. It is intended later to extend the Bradley elevators to the second house, when this is built.



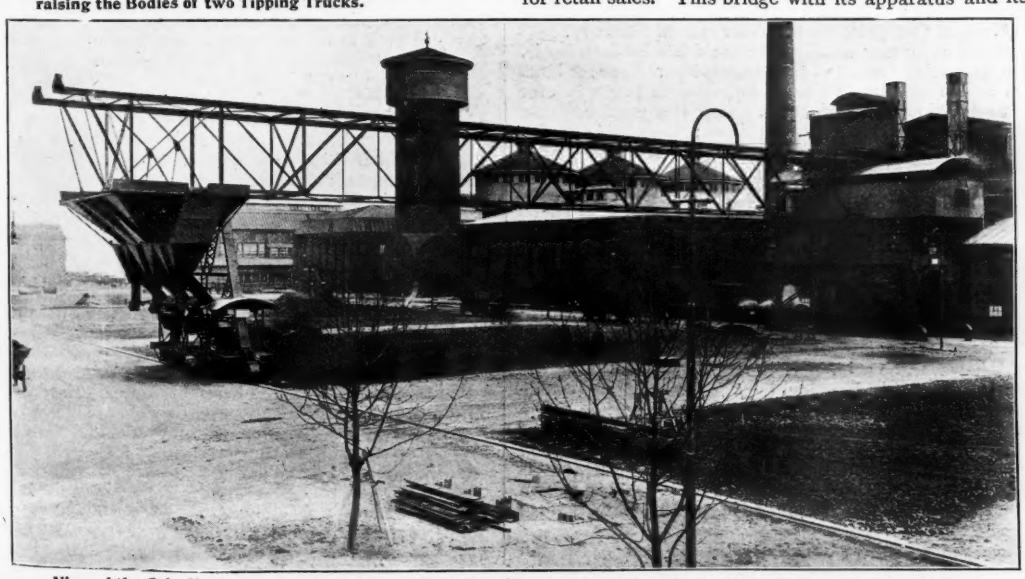
The Grab-Crane and Telpher Skips on the Coal-Yard Bridge.

The Coke-Handling Plant at one End of the Bridge, with the Crane raising the Bodies of two Tipping Trucks.

The coal yard is spanned by a bridge 164½ feet in length, which can be moved from end to end of the yard. A suspended rope railway works up and down this bridge, and can deal at present with 80 to 100 tons per hour; and the capacity can be doubled by introducing more skips. For emptying the skips over the storing yard, there is on one side of the bridge a releasing device which can be operated at any desired point. When it is required to take coal from the store to the breaking plant, the suspended skips are filled at the centre of the bridge, where a hopper with two filling shoots is fitted. This hopper is fed by a grab-crane, which can move from end to end of the bridge and can supply the hopper with about 80 tons of coal per hour. The bridge itself is of girder work, with two rigid supports. The motive power is supplied by means of a 27 H.P. electro-motor fitted in the bridge, and is communicated to the driving wheels by one horizontal and two vertical transmission shafts. The grab-crane has a lifting motor of 70 H.P., a motor for revolving power of 4½ H.P., and one for driving of 27 H.P.

Coke-Handling Plant.

The coke falls from the retorts into De Brouwer troughs, in which it is quenched by automatically working sprays. The sloping part of the trough is kept as low as possible, as it is here that the coke suffers most. The coke is delivered direct into small tipping trucks, in which it is allowed to dry. The trucks are drawn by an electrically driven capstan to another line, and there shunted and dispatched to wherever the coke-handling plant happens at the time to be. The latter is fitted to one end of a travelling bridge, which in its other end-support further contains hoppers for retail sales. This bridge with its apparatus and its bunkers



View of the Coke Yard, showing the Bridge with the Breaking and Screening Plant and the Hoppers for Retail Sales.

can be driven from end to end of the coke yard. Moreover its lines run parallel to the railway lines, so that the loading of trucks is rendered extremely easy. On the top girder of the bridge runs a crane, which raises at once the detachable bodies of two tipping trucks. These can be emptied where desired by the man in the driving box above. Coke is removed from store in much the same way, the bodies being let down and filled by hand. The bridge is driven by two motors, one of 25 H.P. at the screening-plant end, and one of 10 H.P. at the supporting end. A certain amount of play is possible, and the driver can see by an indicator in his cabin the exact relative positions of the two ends. When one motor gets a certain distance ahead of the other, the current which drives it is automatically cut out, and is only switched on again when a normal position is reached.

The breaking and screening plant consists in one breaker and two jigging screens—the latter so arranged that they exactly share the work. Underneath are the bunkers for sorted coke, with shoots for filling the railway trucks on one side and the holder portions of tip trucks, mentioned above, on the other. Thus the crane can be used also for taking sorted coke to the retail bunkers at the other end of the bridge. Here are arrangements for directly weighing the coke and filling sacks with it. At each charge of the retorts there are some 15 tons of coke to be dealt with. In designing this plant it was constantly kept in mind that coke must be moved about as little as possible, not be unnecessarily loaded up and unloaded, and never have a free fall. The system has the further advantage that the coke store, which is really also the works yard, is quite free from appliances when little or no coke happens to be in stock. Coke for the producers is raised in the usual way by means of a lift, which is situated on the northern side of the house, with a steam-driven lift as an emergency reserve.

The plans for the whole of the coal and coke plant were prepared by the Frankfort Gas Company. The electro-motors are used throughout with current of 220 volts generated on the gas-works.

THE LITERATURE AND WORK OF THE B.C.G.A.

The nature of advertising matter for use by an industry subjected to competition is of the utmost importance. It must be of a character that will appeal to all and sundry whose position in the world of affairs does not give them the same knowledge as that possessed by the producers and vendors of the commodity advertised. It must be literature that goes straight to the point; and the soundness of the reasoning must be such as to convey its quality to the lay reader. When the patronage of any person is sought—be that person man or woman—sophistry is not the best means to obtain it. If possessed of ordinary intelligence, he or she does not want to be treated to platitudes, but rather to something of a commonsense order that will induce the reader to think, and, thinking, will produce conviction. Illustrations, too, must be chaste, artistic, and something that will appeal to the refined taste. Grotesqueness or the comic order of illustrations does not induce serious consideration; it savours too much of a method favoured by the charlatan. It may suit the tastes of some people; but not those whose custom is most desired. All that meets our ideas of what good and profitable advertising literature should be is found in the productions of the British Commercial Gas Association.

A fresh batch of the Association's advertising literature has reached us; and we can recommend it as highly suitable for the purpose for which it is intended. There is a foolscap size booklet, entitled "Gas as an Instrument in Domestic Hygiene." It should be placed in the hands of all interested in educational matters and hygiene. The teachers require teaching; all who have any influence in advising on lighting and heating matters want to know the truth concerning the employment of gas for these purposes. Superficial considerations sometimes play a very misleading part. They do so in connection with lighting and heating. The articles that comprise the matter in this booklet have appeared in "Education;" and they are from the ready pen of Miss Nora M. Ramsay, who has the gift of presenting points in an invitingly plain and telling manner. There are original articles; there are articles that extract the essence from the investigations and writings of scientific authority. The gas industry has to be alert in seeing that such literature as this reaches those for whom it is designed. Information comes that "Truth" and the "Standard" are going to devote special pages periodically to electrical matters. This is a means—special pages on special subjects—that some general newspapers adopt for swelling their advertising custom. But such movements as those of "Truth" and the "Standard" have to be counteracted when a competing industry is concerned; and one way of doing this promptly is to circulate literature that presents the other side of the story.

Among the batch of new circular literature are leaflets, cards, &c. We may specially mention an attractive pamphlet for hotel proprietors and managers, in which the case is presented for adopting gas-fires in hotel bedrooms. This is a good business proposition for hotels and for gas suppliers; there being means available now by which the hotel visitor can use a gas-fire without any pre-arrangement, knowing that a little meter is recording the consumption, and that the cost of procuring the convenience and comfort will be found duly registered in the hotel bill. There is one more leaflet to which special reference may be made. It deals with gas and electricity for lighting buildings, and consists of a reprint, with side headings printed in red, of a paper presented by Mr. F. W. Goodenough to the Architectural Association, and revised by him, so as to bring it up-to-date. There is the irrefutable argument here. We cannot specifically notice the other new productions. They are all of the same excellent quality. This should, however, be said, that the greater the business the Association can do in this direction, the cheaper will they be able to sell their productions. But these will never come down to the price of the leaflet (say) of the pill manufacturer. Quality of paper, of coloured illustration, of printing are all essentials in good advertising by leaflets; and they all cost money. But, in this respect, the quantities the co-operative work of the Association enables them to print, are a distinct advantage to the individual undertaking.

There is one more fresh publication to be noticed. The staff have been at considerable pains collecting the editorial notices that appeared in the General Press of the first annual conference of the Association held in Manchester; and these have been printed in a foolscap booklet. Until this production came to hand, we had no very definite notion as to the amount of publicity that the conference obtained. Those gas managers who want to show their Boards and Committees the solid recognition the Association then received from the general press cannot do better than procure copies of this booklet, at the modest price of 6d. each, and distribute them among their administrations. It shows that the Association is a live, active organization; and there is testimony in it that must induce some outstanding directors and committeemen to now favourably consider the question of becoming members, and contributing to the maintenance of its work. We have said before that, as time progresses, the necessity for the Association will become stronger and stronger. This is proving true. There was never greater need for it than to-day; and we shall be able to say the same thing, with still more emphasis, at a later date.

ASSOCIATION OF CONSULTING ENGINEERS.

We have received from the Hon. Secretary (Mr. A. H. Dykes) a copy of the report of the Committee of the above-named Association. It shows that the number of members is now about eighty. It is pointed out that similar organizations exist in the United States, Germany, Austria, and other countries; and the Committee explain that an immediate cause of the formation of several of the Associations was the great loss and expense caused to manufacturing and contracting firms, and thus indirectly to the public, through the waste occasioned by each firm tendering having to draw up its own scheme and prepare detailed specifications for the work, instead of being able to tender to a definite specification drawn up by one independent expert. A communication has been received from the Belgian Association intimating that, in conjunction with the French Association, they propose to organize an International Congress of Consulting Engineers and Engineering Experts on the occasion of the Ghent Exhibition, and inviting the co-operation of the English Association. The Committee express the hope that it may be possible to arrange for representatives to attend the congress, the object of which is the formation of associations of consulting engineers in all countries and the creation of an International Federation of Associations of Consulting Engineers. The Committee had under consideration certain standard conditions of contract prepared by the British Electrical and Allied Manufacturers' Association, and submitted with a suggestion that they might be adopted in all specifications to which their members tender. The Committee, however, came to the conclusion that it was impossible to frame a single set of conditions applicable to all contracts; nor had they been able to draw up a scale of professional fees for the use of the members. At the same time, they decided to issue a set of rules governing the professional practice of members, dealing broadly with the lines on which they carry on their profession. The Committee call attention to the action of Government and Municipal officials in taking engagements as consulting engineers—a practice which they consider occupies a considerable amount of time, and reduces their efficiency as public servants, for which they are primarily remunerated.

Shale Oils and Tars and their Products.—Under this title, Messrs. Scott, Greenwood, and Son have just issued a book (translated from the German) by Dr. W. Scheithauer. The work is intended to depict the production and utilization of the distillation tars constituting the basis of several important industries. The chief of these are the Scottish shale-oil industry and the Saxon-Thuringian mineral oil industry—the latter forming a branch of the lignite mining industry of Central Germany. In addition, the production and utilization of distillation tar is practised at Messel, near Darmstadt; and a detailed description is given of the methods, apparatus, &c., employed at each of the above centres. Some further notice of the book (which is published at 8s. 6d. net) will appear later on.

AN EXPERIENCE WITH "METRO" GAS-BURNERS.

By A. F. B. (of the "Journal" Staff).

One must speak as one finds things. Towards the end of 1910, a temporary interest was aroused in the gas industry on the subject of fixed gas and air regulation *versus* gas and air adjusters for inverted incandescent gas-burners. There were then few men in the industry who believed that, under the ordinary conditions of gas supply, it would be possible to dispense with gas and air adjustment using inverted burners with their smaller flow of gas in relation to candle power, compared with what had gone before. Variations of pressure, of composition, and of density arrayed themselves against the idea of the successful application of fixed gas and air regulation. From his study of lighting questions, and some photometrical investigations under such conditions as were available in a private laboratory (some of these investigations being made in the district of the South Metropolitan Company, but not with the "Metro" burner), the writer felt a little diffidence in accepting the statement that inverted burners that were not equipped with means for gas and air regulation could be lastingly satisfactory. He knew that Mr. Charles Carpenter had been working on the subject, and that, at the time Mr. Carpenter first referred to the "Metro" gas-burner in the "Correspondence" columns of the "Journal" towards the end of 1910, a large number of burners with fixed gas and air adjustment were being used in the main streets of South London; and he also knew that similar burners were being made for domestic service. But as the writer, at that time, looked at the efficient service that was being rendered by the burners in street lamps in the area of the South Metropolitan Company, he asked himself what this efficiency was entailing in the matter of maintenance and labour. There was suspicion there born of personal inexperience with the burner.

Since then, there has been personal experience, and an experience continuing for more than twelve months, with nine of the domestic "Metro" burners—four of the medium size, and five of the bijou—in the writer's house in the district of the South Metropolitan Company. The experience of the writer is to-day that of thousands of consumers in the Company's area; but if the burner were transferred to some other area, if all the care that is exercised on the proportioning of the gas apertures in the ejectors of the burner were practised, as it would need to be, for any other gas supply at a given pressure, composition, and density, unless the conditions were maintained, or approximately so, there would undoubtedly be some trouble with the burner. The burner has several commendable points apart from this one of fixed gas and air adjustment; but that is the cardinal feature. And the reason why a high efficiency is not only obtained, but is maintained, with the burner is that the South Metropolitan Company work to standards in relation to their gas supply in order to keep it as uniform day by day as it practically can be. It is impossible, we have been told by one lecturer, to regulate inverted burners by the ordinary tap alone. It is quite possible to do so with the "Metro" gas-burner on the gas supply of the South Metropolitan Gas Company. The house in which the writer's experience has been obtained is at almost the same level as the cross on the dome of St. Paul's Cathedral. The service-pipe has an ordinary governor upon it. Unless, however, the tap is turned so that the burners are perfectly noiseless, the maximum efficiency from the burners is not obtained. When the maximum efficiency is being realized, the burners are perfectly noiseless; and as a tap must be turned to some point, it may as well be to the proper point, at which the best result is secured. A governed service has been mentioned. But the burners are used with and without gas-fires in use, as well as with and without a gas-cooker in use. Under all conditions, there has been no visual change in the high results of the burners over the more than twelve months of their daily employment—not even during the coal strike of 1912, which says something for the work of the Company in preserving the character of their supply during that period of pressure. Other experience with the burners has been obtained in the houses of friends, where the service-pipes are not governed; and the experience has been consistent with the writer's. This excellence of result comes not from the burner alone, but from what is understood, from the speeches of the Chairman of the Company at the meetings of the proprietors, to be the dominating principles that direct the Company's actions in their business relations with the consumers. The main one is that the consumer must, in these days of severe competition, be relieved as much as is practicable from personal inconvenience and labour in maintaining the highest efficiency of his gas appliances; and the fundamental source of relief from trouble is the constancy of the quality and density of the gas itself.

The nine "Metro" burners that the writer has had in use now for close upon fourteen months—they were fitted up on the first Monday in March last year—have been almost in daily use since then; at any rate, it can be positively said that the medium size burners have been in daily use since their installation. The burners themselves have not been touched or cleaned in any way; and there is no apparent diminution of illuminating power. Neither the writer nor anyone in the household can detect any. It is a matter for regret now that an illumination test was not made when first installed, for comparison with one now. But there is something more in the nature of a hard fact that is notable; and it is the mantle consumption. "Consumption" is not a strictly accurate word to apply. When the burners were first installed, "Metro" mantles were put on by the Company's fitter; eight out of nine of these mantles are in use to-day, and have not been removed once from the burners. There is no occasion to remove them—the light is good, there is no visible depreciation, and the burners are clean. The ninth mantle met an untimely end six days after it was introduced to the service of the household, through a visitor investigating the ease with which the globes can be removed for cleaning by means of the form of support provided with the "Metro" burner. A mantle of a different make was then put on to that burner; and this mantle has only been replaced by a new one within the last fortnight. So that all the mantles have had over twelve months' use, and eight of them are still running, and are giving no indication of any intention to terminate their useful days.

It will be remarked, from what has been said so far, that a good illumination has been constantly obtained in the rooms in which these burners are in use with the minimum of trouble, and not a penny piece has been spent on them (save for the one mantle) since they were installed. Those who know the "Metro" burner are aware that in its design—the ejectors are not the only part upon which there has been ingenuity brought to bear—everything possible has been done to facilitate maintenance; and there is an incomparable freedom about the manner in which the structural portions of the burner can be taken apart, and the globe removed from the burner. The one objection, to the mind of the writer, is that a bayonet socket has to be brazed to the fitting, thus preventing the fitting being readily used afterwards for any other type of burner, if one wishes to make a trial of anything new. However, when one gets past this bayonet socket, all is plain sailing. The parts of the whole burner can be detached one from the other through the simplicity of the connections. Through the neat and ever-clean porcelain corona, with its two openings and deflectors, there is absolute protection for the metal work of the fittings. There has been no deposit or discoloration of any kind on the fittings with which the burners have been used in this experience; and the three fittings are in different finishes—brass, bronze, and steel. The porcelain corona is formed with an in-turned lip, slotted in three places, for the passing of three projecting supports formed on the top part of the globes. The globes are simply slipped up, given a turn, and the projecting pieces rest on the in-turned lip. Little stops are provided on the lip at the slot openings, so that the globe cannot come to grief through dislodgment by vibration. The ease with which globes can be removed for cleaning purposes and replaced later, instead of having three screws to attend to when removing and again when replacing the globes, eliminates the irksomeness of the duty of globe cleaning. The greater the ease given to the system of globe removal and replacing, the cleaner are globes kept; and thus contribution is made to the maintenance of illumination efficiency. It is to be feared that unskilled hands and globe-supporting screws, and insufficient thought on the part of the user as to expansion and contraction of glassware, are responsible for the greater part of the breakage of incandescent burner globes. The glasses of the "Metro" burners with which the writer has had continuous experience during now nearly fourteen months are those that were placed on the burners when first installed. They have only been removed for occasional cleaning.

The writer has changed his views regarding fixed gas and air adjustment with inverted gas-burners—where the character of the gas supply allows it. It is not essential that the supply shall be a straight coal gas for the fixed regulation. The ejectors can be proportioned to suit any composition and pressure of gas; but there is one thing that is demanded, and that is—this is a matter of first importance in gas supply to-day—an approximate constancy in both respects.

A great deal of work has been expended upon the "Metro" burner in perfecting it; a great deal of work is expended upon every burner in ensuring its individual perfection. This the writer knows from report, and from the evidence that each burner presents that has come under his immediate notice. The experience is given as being of practical value through being derived—not from laboratory experience, but from ordinary everyday domestic procedure in the matter of artificial lighting. There is nothing in this of a "solicited testimonial;" it is written and published solely because the writer believes it will be of interest. No one connected with the Company has been to see, and so no one connected with the Company has touched, the burners since one of their own fitters installed them. No one associated with the Company knows that this account of experience is being written; so that, until it is seen in print, no one connected with the Company knows it is going to be published. The first words of this article are: "One must speak as one finds things." This is all that has been done here. The outstanding lesson is that, given constancy of gas supply, fixed gas and air adjustment for inverted burners is practicable; and this points to an obligation on the part of the gas industry. To strive to comply with this obligation in these times, is worth an effort; it is, in fact, worthy of being, in the cause of continued prosperity, the predominant aim of gas manufacturers.

The Keighley Town Council have decided to increase the salary of Mr. W. Baillee (Gas Engineer) to £375—a rise of £100—though the Gas Committee only recommended an increase of £75.

A VISIT TO DROITWICH

By the Midland Junior Gas Association.

GENERAL VIEW OF THE DROITWICH GAS-WORKS.

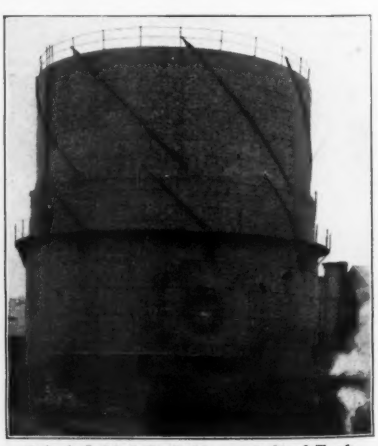
Some fifty or more members of the Association journeyed to Droitwich on Saturday afternoon, at the invitation of their President, Mr. F. Shewring, to inspect the gas-works, of which he is in charge, and the other attractions which have secured to the town world-wide fame. No doubt, had the weather outlook been more promising there would have been a larger muster of members; and with those who failed to join the party sympathy was felt, for the threatening rain held off, and the outing proved to be a thoroughly enjoyable one in every respect. Droitwich—with a permanent population of something over 4000, which is doubled at the height of the season by visitors—is not a large place; but what is lacking in size is made up for in other respects. The lovely surroundings would alone ensure for it a desirable measure of popularity; and when to these are added the noted brine baths, the right of Droitwich to a very high position among health resorts must be at once admitted. A varied programme had been arranged; and on arrival at the railway station, the members were met by the President and divided up into two parties, each of which went through the visits in a different sequence. Thus crowding was avoided, and everybody could see in comfort all there was to be seen.

At the Gas-Works.

From an excellent *souvenir* prepared for the occasion, the members will no doubt learn more of Droitwich on their return home than they were able to do during a brief afternoon on the spot—in spite of the able guides who were at their disposal. On the first pages of this booklet, will be found some interesting information with regard to the gas-works, which were, of course, one of the places visited. The town was first lighted with gas in 1837; the works (which were in private hands) being built on a portion of the existing site. When in 1878—43 years later—the Town Council acquired the undertaking, the manufacture of gas was no more than 4 million cubic feet. The leakage, however, was high, if the output was low—namely, nearly 20 per cent. As to the price of gas, this was 6s. per 1000 cubic feet. Alterations which were carried out in 1899 and 1900 included the pulling down of the old retort-house, which contained direct-fired settings, and the erection of the present house fitted with regenerative settings. New purifiers, &c., were also installed. The Manager at that time, it is mentioned, was Mr. A. T. Harris, now of Market Harborough. Mr. F. Shewring was appointed Engineer and Manager in 1908, just at a time when the development of the town and the consequently increased demand for gas rendered necessary the acquisition of additional land, and the further extension of the plant. Thus since his appointment quite a lot of new work has been carried out, nearly the whole of the cost of which has been defrayed out of profits. The present loan indebtedness of the undertaking is £4152; and the price of gas to ordinary consumers is 2s. 6d. and 2s. 10d. per 1000 cubic feet, and for gas-engines 2s. and 2s. 6d. The make of gas for the twelve months ended the 31st ult. was 24,667,800 cubic feet.

The gas-works are, of course—as will be gathered from these statistics—small, but are none the less interesting from this fact; and there are some unique features, arising from the peculiarities of the district. In the first place, brine springs are to be found under almost any portion of the works; the brine in some cases being met with at as small a distance as 6 or 7 feet from the surface. Difficulty in gasholder tank construction has in three cases been considerable—in two of the tanks, in fact, the trouble was never really overcome. In connection with the present column-guided holder of 68,000 cubic feet capacity, which was put up in 1889, the brine proved to be a difficult obstacle to contend with, and necessitated considerable expenditure. A small gasholder was taken out last year, close to the one just mentioned; the intention being to utilize the tank as a tar and liquor well.

Reinforced Concrete Coal-Store in Course of Erection.



Spiral-Guided Gasholder and Steel Tank, completed the latter end of 1912.

For this purpose, a reinforced concrete roof was put on, the slab itself being 4 inches thick, with cross beams. When, however, the tank was being emptied, and pumping operations were suspended during the night, it was found that the brine was rising, and continuous pumping had to be resorted to. The bottom was therefore strongly puddled and concreted, with reinforcement; but this has proved ineffectual in making the tank tight, and further steps are now under consideration. The close proximity of the holders to the Birmingham Canal has probably also an influence on the stability of the subsoil. In one way, the canal is useful, as such of the tar as is not disposed of locally for road spraying, is sent off by boat. Coal and all materials, however, are carted into the works from the Great Western sidings about 200 yards away.

The retort-house contains three settings, of eight, six, and four retorts respectively, on Drakes' regenerative system. Arrangements are being made for the erection of a new bed of eight retorts, and for the modernizing of the setting of four, all on the same system. The average make per ton for the last five years has been about 11,100 cubic feet; Derbyshire and North Wales coal being chiefly used. A tar-tower and retort-house governor are installed; both being found by Mr. Shewring to be valuable adjuncts to the carbonizing operations. Work is carried on with $\frac{3}{8}$ inch seal, and $\frac{1}{2}$ inch pull. A "wrinkle" was mentioned by the President in connection with the retort-house governor. Being worried some years ago with stopped ascensions on an old setting, he arranged pipes from the water overflow of the governor to the troublesome pipes. This assisted in preventing blockages, which were found to be more frequent in the saddles than in the ascension-pipes themselves. This device, of course, saves the expense of specially providing a water-tank, and in addition makes use of water which might otherwise run to waste.

The condensers are three in number, of the annular type. In the engine-house, there are two sets of exhausting machinery; one having been installed about two years ago by the Bryan Donkin Company. The capacity of this is 12,500 cubic feet per hour. A fresh water pump and a liquor pump—both by Messrs. Joseph Evans and Sons, are also found here, as well as an arrangement for injecting air into the purifiers. This was explained, and its benefits detailed, by Mr. Shewring in the course of his Presidential Address to the Association last October [see "JOURNAL," p. 227]. It was pointed out that the engine-house was enlarged to make room for the new machinery, and at the same time provision was made for a large cast-iron overhead tank, for water storage purposes. The gas passes through a tower-scrubber, which is filled with 3-inch drain pipes. A Livesey washer of 250,000 cubic feet per day and a Cockey washer of the same capacity comprise the washing plant. For purification all oxide is used; one of the five boxes being filled with hurdle grids, and the others will in due course be similarly equipped. Two of the boxes are 12 feet square, and the other three 8 feet square. The station-meter, of 7000 cubic feet per hour capacity, is by Messrs. Parkinson and W. & B. Cowan; and housed with it is an 8-inch double-cone governor by the same firm. The sulphate of ammonia plant, by Messrs. R. & J. Dempster, is of a capacity of 50 cwt. per week; and in connection with this, the members had an opportunity of inspecting for themselves the overhead liming arrangement which was also described by the President in his address. The excellent colour of the sulphate in stock—which was quite equal to anything seen in connection with larger plants—was matter of remark. A thermometer was observed fixed in the primary still of the plant; the object of this being to control the temperature of the liquor before passing to the secondary still. Other points deserving mention are the new fitters' shop, the blacksmith's shop, and the provision of bathing arrangements for the workmen—an addition to their comfort not invariably to be found in works of this size.

Among the newly carried out work is a two-lift spiral-guided holder, with steel tank above ground. This holder was erected by Messrs. Westwood and Wrights, and was brought into operation towards the end of last year. The capacity of the holder is 100,000 cubic feet, and the tank foundations are a feature of interest. As already explained, the works are water-logged with brine springs, and hence particular trouble is experienced in connection with all foundation work. It was therefore decided that the tank should be entirely above ground level, and be placed on a concrete foundation supported by piers at intervals round the circumference. The concrete slab is 2 feet thick, reinforced with two layers of Clinton wire-mesh—all joints being electrically welded. There are nine piers, varying in depth from 4 ft. 6 in. to 7 feet. At the bottom tier of the steel tank, the lowest factor of safety is 5·4.

Then, in consequence of the coal storage room in the retort-house being taken up with a new setting of retorts, it was found necessary to provide further coal storage accommodation, and this was done by the erection of a reinforced concrete building, with open front—the reinforcement being on the indented bar system. The work was duly carried out by Messrs. Tilt Bros., of Bromsgrove, who also put up at the same time a covering over the purifiers, with a reinforced concrete end. The new coal-store was erected in this form with the special object of economizing ground space. The bottom of the wall is 8 inches thick, tapering to 4 inches, and the building is 12 feet high to the eaves, with a capacity of 200 tons. Had it been determined to utilize brickwork, it would have been necessary to provide 18-inch brickwork at the base, or 14 inches with buttresses. The entire building is fire-proof, being composed entirely of metal and concrete. The roof consists of what is termed corrugated sheathing—the main constituents being asbestos and cement—which is very durable, and does not require any painting. The front corners of the end walls are protected from damage by passing cart-wheels by the fixing of angle irons, bolted through the wall, to a height of about 5 feet. The purifier shed roofing is composed of asbestos cement "shingles," laid diagonally.

Some Other Visits.

During the afternoon a visit was (by permission of the Manager, Mr. T. Young) paid to the Covercroft Works of the Salt Union; and here some of the members who had had no previous experience of salt making were a little surprised at the simplicity of the whole process—and more particularly of the method of firing. It was seen that the brine is pumped into enormous shallow tanks over the furnaces; and after being heated for about a couple of hours, the salt which has been deposited at the bottom by the process of evaporation is fished out and filled into wooden moulds. Subsequently the salt is removed to the drying-room, which is heated by the flues from the furnaces already mentioned. At Droitwich, a ton of salt is recovered from about 1000 gallons of brine. Acquaintance with another branch of the brine industry was made at the St. Andrew's Baths, where those who, by their own wish or their doctor's orders, are seeking a brine treatment can be accommodated with baths of every kind. Here the party were in charge of Mr. J. H. Hollyer, the Secretary and Manager, at whose request a few of the members demonstrated the peculiarities of the swimming-bath. The Droitwich brine, it seems, is the strongest in the world—being ten to twelve times stronger than the ocean, and of nearly twice the density of the Dead Sea. Analysis, in fact, shows that Droitwich brine contains in every gallon 20,000 grains of saline constituents in excess of that possessed by other European mineral springs. This being so, there is no need to wonder at the popularity of Droitwich for certain curative purposes. A very short walk from the baths, brought the members to the Brine Baths Park—a charming little natural park which, even at this time of the year, is well worth a visit. After strolling round here, a move was made to the Salters' Hall, where tea was served (to the accompaniment of the baths orchestra) in the large concert and reading room.

Welcome and Thanks.

The PRESIDENT, after tea, announced that he had received a number of letters of apology for absence; and he then asked the Mayor to make a few remarks.

Councillor P. POND (who wore his chain of office as Mayor of Droitwich), in response, extended to the Association a very cordial welcome. As they had seen, he said, Droitwich had two industries which were carried on side by side. One had existed for an unbroken series of nearly 2000 years, and the other for almost a century. The first was the manufacture of salt, which was carried on now in practically the same way as in the Roman times; and the second was the modern industry of health-giving. Naturally, as a progressive borough, they were anxious to make use of all the best things; and so they took up gas. One of the most interesting phases of modern municipal life was the extent to which corporations lent themselves to reproductive enterprise. Putting aside the large amount of capital that was employed in limited companies, and taking only the local authorities, the sum of money sunk in gas undertakings was almost inconceivable. As any movement became more important and more rapid, so it tended to attract to itself men of a higher and higher stamp; and he took it that the object of their Association was to provide men of higher and still higher qualities, who would remain a credit to the profession of gas engineers. They desired to raise the status of the gas engineer, to see that he became more and more respected among the community, and to produce men of the type which their President, Mr. Shewring, typified—willing men, keen men, scientifically trained, well versed in every ramification of the duties of a gas engineer, and men who were eager to extend their business and see that the Association with which they were connected should thrive under their care. He regretted that Alderman Jackson Gabb, the Chairman of the Gas Committee, was unable to be with them that afternoon. He had been Chairman for very many years; and it was under his guidance, with the assistance of late years of Mr. Shewring, that the gas undertaking had been raised to the state of prosperity which it now enjoyed.

The PRESIDENT thanked the Mayor for his hearty welcome, which he said was greatly appreciated by the members. The work of their Association should not only benefit the members themselves, but the communities they served. Personally, if he visited a works, it was with one object—namely, to endeavour to know something more when he came out than when he went in. This, he thought, was the idea of the members generally. He wished to thank the members for coming to Droitwich, and the Mayor, Alderman Gabb, Mr. Hollyer, and Mr. Young for the great assistance they had all rendered in connection with the visit.

Mr. W. H. JOHNS remarked that the visit had been a very interesting one. He had been particularly struck with the crude method of firing adopted at salt works. This appeared wasteful; and probably the Gas Committee could come in and increase their profits by introducing some system of gaseous firing. There seemed to be no reason why gas should not be utilized. In the Potteries, ordinary direct-fired furnaces had been in existence, and now gaseous firing had added considerably to the profits of the pottery people. He noticed that the consumption of gas in Droitwich had increased very considerably in the five years that Mr. Shewring had been in charge of the works, while the price had been reduced 6d. per 1000 cubic feet. At the present charge, it could probably be used economically for the furnaces in the salt works. In Birmingham, they had replaced many coke fires with high-pressure gas; and there was no reason why this should be

confined to large towns. He thanked them for the way in which they had received the members and entertained them that afternoon.

Mr. F. J. WARD proposed a hearty vote of thanks to Mr. Young and Mr. Hollyer, and said that in his opinion the salt industry of Droitwich was a credit to the town.

The vote was heartily carried, and

Mr. HOLLYER responded—expressing regret at Mr. Young's unavoidable absence. Referring to the baths, he said they claimed that they contributed in a large measure to good health, and as light and warmth were also valuable factors in connection with health he had come to the conclusion that gas engineers and himself were engaged in the same field. Mr. Johns had referred to the possible application of gas to the operation of salt making. When he was engaged at a neighbouring salt works nearly thirty years ago, they did try to boil the brine by gas; and the result was that they blew the pan into the air about a dozen times. [Laughter.] They had all been pleased to do what they could for the Association that afternoon.

Councillor WILLIS asked the members to join with him in wishing "Success and Prosperity to the Midland Senior Gas Association," of which the Junior Association was the offspring. In doing so, he wished to endorse the words of welcome that had been uttered, and the complimentary references made to their President, whose efforts he greatly appreciated. Associations such as theirs and the senior body must be of great benefit, not only to the gas industry, but to the community they served. He hoped the visit would prove profitable to the members, and assured them it was regarded as a great honour and privilege that they should come to the town. He coupled with the toast the name of Mr. W. J. Rendell Baker, of Malvern, the Vice-President of the Midland Association of Gas Engineers and Managers.

Mr. BAKER, in response, expressed regret that Mr. W. S. Morland, of Gloucester, the President of the Midland Association, was unable to be present, owing to a previous engagement. He thanked Mr. Willis for his remarks, and added that if any of those present cared to pay him a visit at Malvern, he would be able to show them something interesting in the way of purification. He had been particularly impressed by Mr. W. L. Heald's address to the Manchester Junior Gas Association, which appeared in the last issue of the "JOURNAL OF GAS LIGHTING." The outlook for the gas industry was never brighter than at present; but Mr. Heald struck a keynote when he referred to the necessity for understanding what oil and electricity were doing. There was no doubt a field for all of them; but if they could understand their neighbour as he understood them, it would be very much better. Electricity had come to stay; and they were broad-minded enough as gas engineers to use it where advisable. They should therefore fully understand it, and be properly equipped to enter the field of competition, and able to talk to consumers in electrical language as easily as in that of gas. Thus they would be greatly helped in their business. He concluded by proposing a vote of thanks to Mr. Shewring, who, he said, he had known ever since he came to Droitwich. Mr. Shewring had reduced the price of gas and increased the consumption; and this was strong evidence of his ability. He had also improved the works greatly; and they were all proud of him.

Mr. R. J. ROGERS seconded, with the remark that Mr. Shewring had conducted the affairs of the Association in a manner that was highly creditable to himself. Their hearty thanks were due to him and to the gentlemen who had so kindly and so ably assisted him in entertaining them that day.

The vote was cordially carried, and the PRESIDENT briefly acknowledged it, expressing pleasure at the success of the visit, which was largely due to Alderman Gabb.

EXHAUSTING COKE-OVEN GAS.

In the "Journal für Gasbeleuchtung" for April 5 appears an abstract of some remarks made by Herr E. Jenkner in a recent report of the Coke-Oven Committee of the Society of German Iron Founders. The author speaks of some interesting experiments made with the object of increasing the output of bye-products, and especially of ammonia. It is well known, he says, that high temperature carbonization gives larger quantities of bye-products than low temperature work, but there is an increased danger of decomposing them or splitting them up. Many methods have been suggested of obviating this difficulty. It has been proposed, for instance, to blow steam into the oven to protect the bye-products; Koppers have a German patent for bringing back again into the coking oven part of the gas purified from tar, ammonia, and benzol, in order to take away from danger more quickly the products of distillation. But this object is more simply and more safely accomplished by taking-off the gas at several points in the arch of the oven—a process in itself well known. Eisenhardt and Dr. Imhäuser have a system by which they connect such openings in the walls (by means of channels in the brickwork) to a horizontal channel above the coking space, which channel is connected with the ordinary ascension pipe—the idea being to take the gas more quickly to cooler surroundings. But when high temperatures are used, these passages or channels in the brickwork must of necessity also become red-hot, and so defeat their own purpose. A much better scheme is to substitute for them external air-cooled pipes, such as have been employed for nearly four years in the coke-ovens of the Hubertus Foundry, and always with great success. These pipes are situated in a separate channel in the brickwork above the heat-flues, and are covered by a grating. The crude gases, on entering these air-cooled pipes, are instantly reduced to a temperature of some 160° C., and decomposition and splitting-up are totally avoided. Naturally a saving is also effected in the space and the amount of water required for condensing operations. A further advantage is that the ascension pipes do not need such frequent cleaning as ordinarily. The deposits formed in them are less in quantity and not so hard, and the work of the cleaner is made easier, in that he is not exposed to the great heat usually given off by ascension pipes. The author then quotes some figures showing the great advantages accruing from the use of this system. The coal used contained roughly 30 per cent. of volatile matter, and yielded per ton some 13,000 cubic feet of gas, of a calorific value of 13,500 B.Th.U. Taking an average of several tests, the ammonia content of the raw gas shows an increase of 28 per cent. (with similar conditions of temperature and pressure) when using this system of air-cooled take-off pipes; and naturally the output of tar and benzol are correspondingly increased.

YORKSHIRE JUNIOR GAS ASSOCIATION.

The usual large attendance of members assembled on Saturday at the Bradford Technical College, to hear a paper, on "Gaseous Firing" [see p. 172], which, in the enforced absence of its author, was read by Mr. W. Cranfield, of Halifax. The paper was prepared as a supplement to the memorable contribution on the same subject which the Association received in 1904 from Mr. J. F. Smith; and in its orderly development, leading up to the most modern industrial uses of high-pressure gas, in its admirably expressed summaries, and in the breadth and accuracy of its scientific outlook, it formed a worthy addition to the earlier memoir from another pen. A series of lantern illustrations which had been specially prepared for the occasion were thrown on the screen.

It was generally realized that a worthy discussion could hardly arise spontaneously; and it was felt to be more in keeping with the importance of the address, and more complimentary to the author, if a later meeting was devoted entirely to a more mature consideration of it—after members had been able to study it in print. Accordingly, the meeting agreed to the postponement.

The members then adjourned to the Thornton Road Gas-Works of the Bradford Corporation to inspect the large installation of Glover-West vertical retorts now in full operation there. The Association had visited them while in course of construction, and the present was an opportunity of seeing them in full work.

SCOTTISH JUNIOR GAS ASSOCIATION.

WESTERN DISTRICT.

Annual General Meeting.

There was a large attendance at the annual general meeting of the Scottish Junior Gas Association (Western District), which was held in the Royal Technical College, Glasgow, on Saturday. The retiring PRESIDENT (Mr. F. L. MacLaren, of Dumbarton), was in the chair.

The HON. SECRETARY (Mr. David Fulton, of Helensburgh), in his report, stated that there were upon the roll 136 ordinary members, 22 honorary members, and two patrons. The papers during the year had all been of a very high standard; and the members had taken a large part in the discussions. The first portion of the meeting was devoted to the election of office-bearers and members of Council. Mr. John Wilson (Falkirk) was elected President for the ensuing year; Mr. Thomas Carmichael (Dawsholm), Vice-President; and Mr. David Fulton was re-elected Hon. Secretary and Treasurer. It was explained that the retiring members of Council at this period were Mr. George Braidwood (Coatbridge), Mr. G. H. M'Cowat (Glasgow), Mr. J. Mann (Glasgow), Mr. Robert Shepherd (Glasgow), and Mr. A. Wylie (Glasgow).

On a vote being taken, the following were elected or re-elected to the Council: Messrs. G. T. Purvis (Auchengeich), G. Braidwood, T. Fraser, A. Wylie, R. Shepherd, and G. Scott.

Mr. J. W. NAPIER (Alloa) then delivered an address, the text of which appears on pp. 167-70.

Removal of Incrustation from Water-Mains.—The Water Committee of the Leeds Corporation have decided to follow the example of Liverpool in dealing with the incrustation of the water-mains, caused by the accumulation of vegetable matter and bacteria, which has become so bad in certain parts of the system that the pressure has been reduced by something like 50 per cent. The Liverpool Committee, who were troubled with the same thing in their trunk mains from Vyrnwy, have been clearing the obstruction by the use of a specially adapted brush, which was found to be very effective in removing the more recent deposits. Having inspected the brush, some members of the Leeds Committee reported in favour of its being tried in one of the 30-inch mains from the Washburn Valley; and it is proposed that the Liverpool Water Engineer (Mr. J. Parry, M.Inst.C.E.) should be asked to confer on the subject with the Leeds Water Engineer (Mr. C. G. Henzell, M.Inst.C.E.) The total cost will be something like £200; and if the use of the brush is as effective as is anticipated, the Leeds Water Committee will be able to put off the laying of a new main which was contemplated.

GAS AUTHORITIES AS THE SUPPLIERS OF ELECTRICITY.

By J. W. Napier, of Alloa.

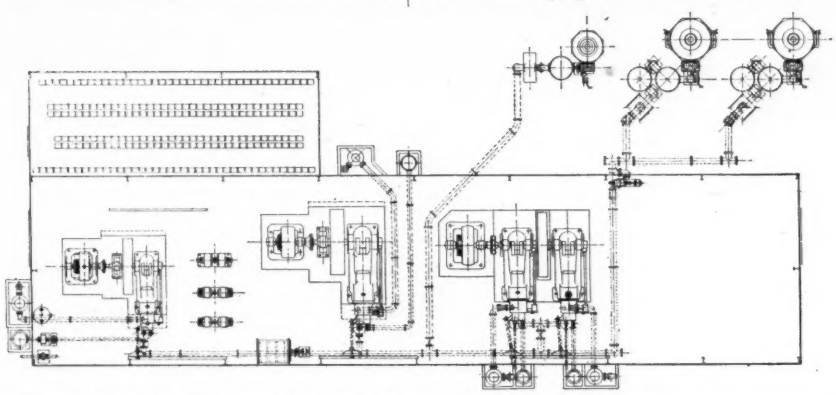
[A Paper read before the Scottish Junior Gas Association, Western District, April 12.]

In the Technical Press, considerable attention has recently been directed to the alliance of gas and electricity supplies. The "Transactions" of this Association do not contain any contribution dealing specifically with the combined supply of gas and electricity from the same works and under the same management. I have, therefore, considered that my experience at Alloa in controlling the dual supply will prove of interest as regards the practical working of an electricity generating station alongside of gas-works management, and the general aspect of the policy as a business proposition.

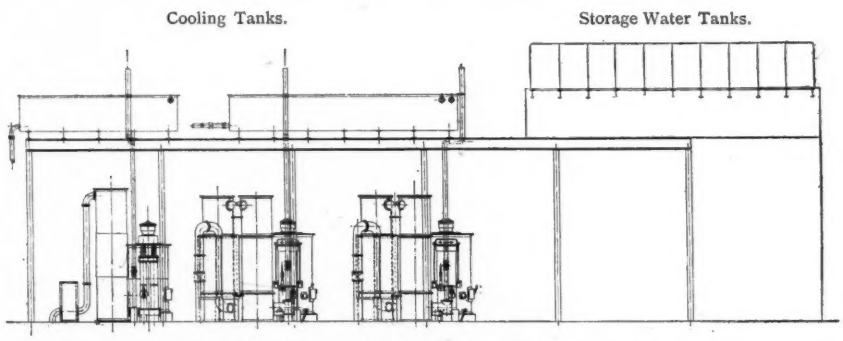
In the first place, I shall describe generally the works erected and the results obtained, and will afterwards deal with the economics of a combined undertaking, in a broad catholic spirit, and of how best the public can be served in the requirements of light, heat, and power. I desire at the outset to bespeak the confidence of my audience, who will understand that there is not intended any spirit of conflict or of opposition to purely gas interests, and that the question before us is the legitimate business of the supply of light, heat, and power for domestic and industrial requirements.

History of the Alloa Corporation Undertakings.

The Alloa Gas-Works are under Corporation control, having been taken over from a private Company in 1878, under the Burghs Gas Supply (Scotland) Act, 1876. The Alloa Electric Lighting Order, 1899, was granted by the Board of Trade under the Electric Lighting Acts now in force. The supply was begun in January, 1902, in terms of an agreement concluded with a local electric plant company for a bulk supply; the Corporation being at the expense of providing a sub-station and the laying of feeder and distribution cables. Until 1910, therefore, the Corporation controlled only the distribution of energy. Shortly stated, the agreement with the private Company for a bulk supply from their engineering works was unsatisfactory. The rates were prohibitive to making the department a financial success—the price charged to consumers for current being too high, with the result that slow progress was made, and a financial loss resulted year by year. The price paid by the Corporation to the supply Company for current was £9 per kilowatt of maximum demand, and 1½d. per



GROUND PLAN OF THE COMPLETE WORKS OF THE ALLOA ELECTRICITY DEPARTMENT.



THE PRODUCER GAS PLANT AND WATER TANKS.

unit supplied. The rates charged to consumers for private lighting were 7d. per unit of maximum demand and 3d. per unit supplied; and for power, 2d. per unit. In 1905, a supplementary agreement was entered into with the supply Company whereby the charge to consumers for lighting was reduced to a flat-rate of 4d. per unit. Notwithstanding better terms of supply, the consumption increased but slowly, while the output for power purposes was practically *nil;* no firm in the town, which is entirely industrial, being found willing to pay 2d. per unit for electricity when gas could be obtained at from 2s. to 1s. 6d. per 1000 cubic feet for power, and for lighting at 2s. 2d. It also followed that some firms were obliged to provide generating plant for their own works, which was regrettable in our interests.

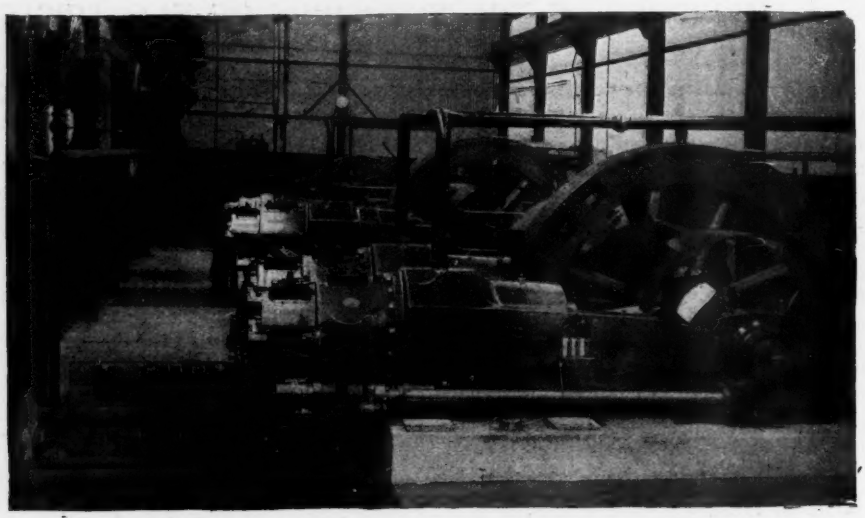
The position of matters became critical; and at last the agreement with the supply Company [at first entered into for a period of fourteen years] was terminated by mutual agreement, and a substantial payment made by the Town Council to the Company as a penalty. The Corporation were then free to erect their own generating station; and this was proceeded with in 1910. In the light of our experience, it may be concluded that an electricity bulk supply from a private company having dividends to provide for its shareholders, and only an indirect interest in the welfare of the community, is not to be commended, and that the local authority itself is the proper party to generate and control the supply. I have thus shortly stated our position in order to explain matters, and point a moral.

The Electricity Station.

The question of site was debated at some length. A piece of ground limited in extent was available near the centre of the area of supply, which was partly residential. It was advantageous only as regards saving in loss of energy in distribution. The disadvantages were the necessity of erecting expensive buildings, as well as the delicate question of amenity—always a contentious matter. The gas-works are situated in the industrial area, and had available a piece of ground to be had for almost a nominal feu-duty, and forming part of the gas-works site. This site was ultimately agreed upon. The advantages summarized are: First, cheap ground—it being surplus as regards gas-works requirements; second, it afforded a cheap fuel supply, also extra labour and assistance when needed; third, saving in cost of buildings; fourth, being in close proximity to other public works, a large supply for power could be given with minimum loss in distribution—a day load being the backbone of an electric station; fifth, it enabled the management to have convenient control over both works, with offices and staff common to both departments.

The Buildings.

The buildings erected comprise engine-house, battery-house, and producer-plant house. The structures are entirely of iron; the sides and roofs being formed of corrugated sheets, upright stanchions of rolled-steel joists. The buildings do not call for special note, except that they have proved to be entirely suitable for the requirements. They are in keeping with the surroundings, are inexpensive, and, if periodically painted, are likely to serve for a considerable number of years. It may call for remark that the battery-house, being formed of corrugated iron sheets, is liable to corrosion from acid fumes given off from the cells; but precautions were taken to coat the inside of the building with a first-class acid-proof paint; and so far this has proved quite satisfactory. The



Inside the Generating Station of the Alloa Town Council Electricity Works.

dimensions of the main building are 120 feet long by 30 feet wide. At present it accommodates three gas-engines of 475 B.H.P. in all, with sufficient space left for installing an additional engine of the vertical type of 400 B.H.P.

As the site is in close proximity to the foreshore of the River Forth (tidal), great care had to be exercised in securing firm foundations, more especially for the heavy engines. For this purpose piling was rendered necessary, owing to the soft consistency of the ground, which was formed of mud—the river having at one time flowed over the area. Pitch pine piles were driven to a firm bottom, and the concrete foundations for the engines were made specially heavy. The security of the foundations has been amply proved during the two-and-a-half years that the plant has now been at work.

Engine Selection.

After full consideration had been given as to the most efficient type of plant to instal—whether steam, Diesel oil-engines, or gas-engines—it was decided that the station should be equipped with gas-engines and suction producer-gas plant to work with gas-works coke. In the matter of reliability, a steam-driven plant may be said to possess the first claim; but with a station having a comparatively small output, precluding the use of the steam-turbine, with a necessarily poor load factor for a few years to come, it was recognized that stand-by losses with a steam plant would be considerable. The extraordinary economy in working of the Diesel engine was fully recognized; but as this type was likely to be considerably simplified in its working parts, and having regard to a fluctuating oil market, it was thought wise to delay its introduction. In any case, our local circumstances for the supply of a cheap fuel were exceptional, and oil could not compete with them. It may be remarked that the Diesel engine provides a wide field as regards the class of fuel that can be used—grading from petroleum and mineral oils down to water-gas tar.

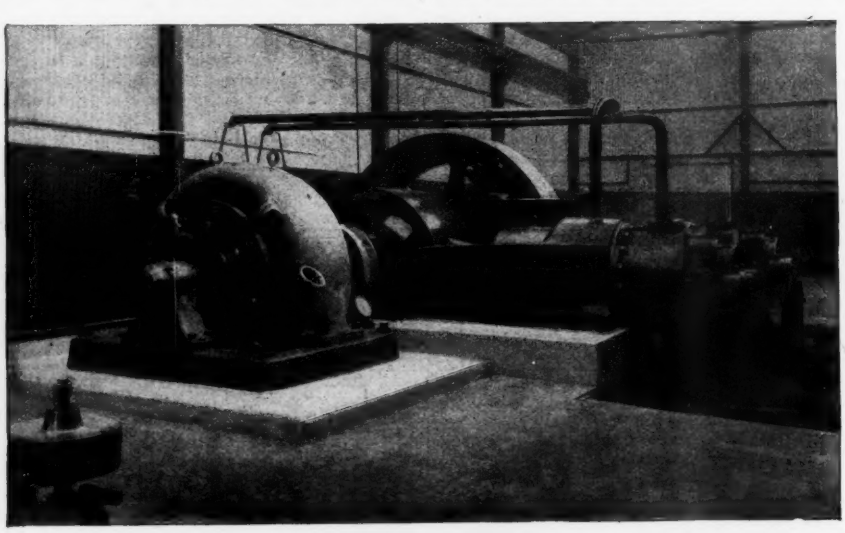
The selection, as already indicated, lay with the gas-engine. These engines have now reached a high state of perfection for electric light supply where steadiness in running is a desideratum. The most important factor, however, in deciding upon the gas-engine was the fact that fuel from the gas-works was ready at hand in the form of coke or washed breeze, and at a price within our own control. Further, in the event of the producers giving trouble at any time, a perfect stand-by was immediately available—viz., coal gas at 1s. 4d. to 1s. 10d. per 1000 cubic feet, according to quantity taken.

Description of the Plant.

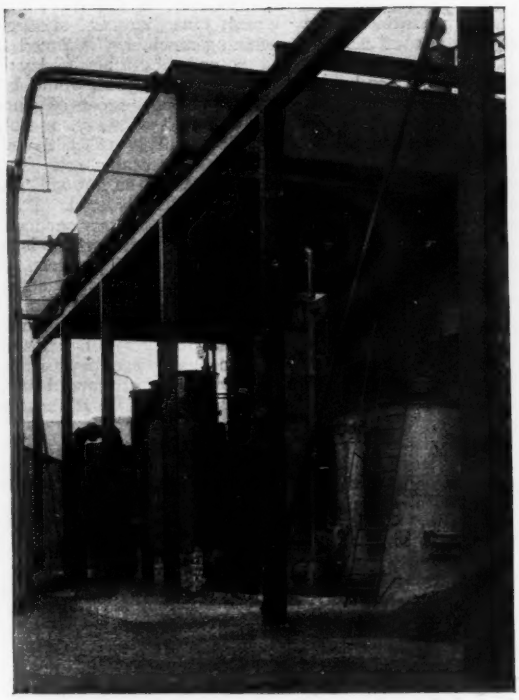
The following is a short description of the engines and plant installed. No. 1 engine, horizontal, single cylinder, 17 inches diameter by 26 inches stroke, capable of developing 80 B.H.P. at 190 revolutions per minute. No. 2 engine, horizontal, single cylinder, 22 inches diameter by 34 inches stroke, capable of developing 155 B.H.P. at 160 revolutions per minute. No. 3 engine, horizontal, twin cylinder, capable of developing 240 B.H.P. at a speed of 170 revolutions per minute. The horse-power stated is obtained when working on producer gas made from coke; each engine being able to meet an overload of 10 per cent. for two hours. The engines, which were supplied by the National Gas Engine Company, are of the most improved type and design, specially suited for electric light generation, having massive fly-wheels. The fly-wheel of the large engine weighs 14 tons. The governing gear is designed so that the impulses are graduated to suit the varying loads—thus ensuring regular running, and therefore steady voltage of electric supply to the consumers. Any one of the engines can be started up at a moment's notice by means of compressed air at 100 to 120 lbs. pressure per square inch. Each cylinder is fitted with two complete sets of magnetos and ignition plugs; and the engines can be run on either producer or coal gas as desired. The dynamos are of the slow-speed continuous current type, direct coupled to the engines through flexible couplings, and in all are equivalent to 309 kilowatts.

Generation and Storage.

The storage battery consists of 221 cells, and is used to supply the town after 11 p.m. as well as all Sundays. One of the chief advantages of the battery is that the gas-engines can be worked at practically full load during the day; the surplus energy generated but not taken up by consumers for power being put into the battery. The makers insure the battery for a period of ten years at an annual charge of 10 per cent. on the purchase price; and they guarantee to keep it in good working condition,



The 240 H.P. Twin-Cylinder Gas-Engine Coupled to the Dynamo.



The Producer Gas Plant and Cooling Tanks for the Gas-Engines.

and at the end of that period to hand it over at its full working efficiency.

It may here be emphasized that in electricity supply as the current required is being generated from the dynamos and sent direct to the consumers—the storage battery being able to furnish only a small percentage of the demand—it is necessary that reliability in the plant be secured. With producer gas, and coal gas at hand as a stand-by, there has been no breakdown so far as the gas supply is concerned; any troubles that have arisen being either mechanical or electrical, in the moving machinery or distribution cables.

The cylinders of the engines are water-cooled on the thermal tank system, which we have found to be most economical and thoroughly reliable when compared with some types of cooling machines which are motor driven and depend on the pumping of the water for circulation. One such machine gave us considerable anxiety owing to breakdown until it was replaced by an overhead tank. The size of the cooling tanks was determined on the basis of 45 gallons capacity per brake-horse-power, the temperature of the water not being allowed to rise above 110° Fahr. in the jackets of the engine cylinders.

Producer Plant.

The producer plant is of the suction type, and was designed of sufficient size to provide ample volume of gas with coke as the fuel. The plant is in three complete sets, and consists of the usual generator, two scrubbers filled with malting coke (which has the distinct advantage of being harder, and lasts longer, than gas-works coke), with a special type of tar-extractor. One of the most serious troubles arising from the use of producer gas is the presence of tar in the gas affecting the working of the valves.

Tar Extraction.

To deal with the tar difficulty, there was installed a three-stage gas-washer by Messrs. W. J. Jenkins and Co., of Retford, direct coupled to a motor running at a speed of 2000 revolutions per minute. The principle of this extractor is to churn the gas rapidly in the presence of an excess quantity of water, and so precipitate the very fine tar fog which cannot be removed by the ordinary type of scrubber. We find, however, that all the tar is extracted in a vessel containing a series of wire grids of small mesh having roughened surfaces, to which the tar mist readily clings. The grids are placed in the form of trays inside a rectangular vessel fixed upright. This form of tar-extractor was at first only experimental, but can be recommended as most efficient—taking out the tar by frictional contact. The water used in the scrubbers is recovered and passed through oxide of iron into underground tanks, from which it is pumped to the overhead storage tank. With this arrangement, and the use of the thermal system for the engines, only a small quantity of additional water is needed from time to time, and the costs for water are therefore low.

Figures of Working Costs.

I have endeavoured to describe briefly, and only in a general way, the plant installed. It is my desire to deal more closely with works costs; and after two-and-a-half years' working of the plant, I am able to place before you the actual figures, which are therefore reliable.

The following statements, representing station costs per unit sold as per consumers' meters with producer gas made from coke at 10s. per ton, include all stand-by losses in producers, loss of electrical energy in working battery, also loss of energy due to resistance in transmission of current through feeder and distribution cables. The basis of cost indeed is similar to that of gas-works costs per 1000 cubic feet of gas sold.

Working Costs—Generating Station.

No. 1.—Station costs for period from May 15 to Oct. 31, 1912.
Total units sold, 72,688.

	Amount. £ s. d.	Per Unit Sold. d.
Fuel	77 10 11	0·256
Wages	210 18 11	0·697
Water	2 8 5	0·008
Stores	14 1 5	0·046
Repairs	20 0 0	0·066
	324 19 8	1·073

No. 2.—Station costs for period from Nov. 1, 1912, to Jan. 31, 1913.
Total units sold, 68,231.

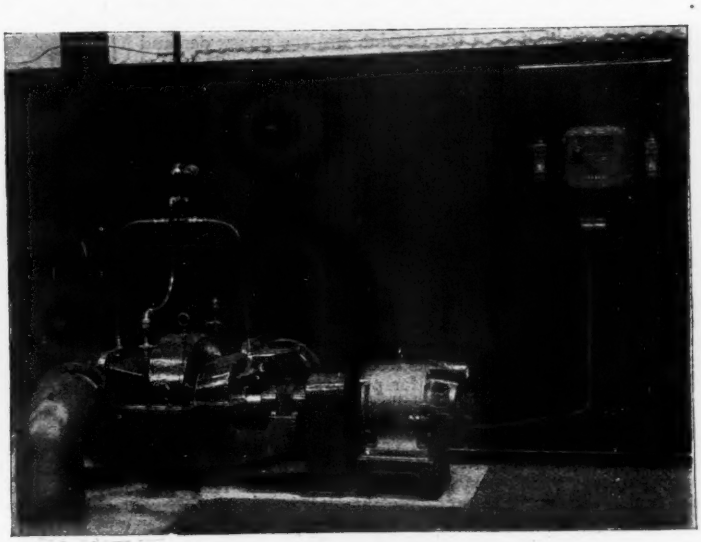
	Amount. £ s. d.	Per Unit Sold. d.
Fuel	58 18 3	0·207
Wages	135 4 2	0·475
Water	0 10 3	0 002
Stores	7 17 8	0·028
Repairs	2 14 4	0·009
	205 4 8	0·721

The regular staff employed at the station is as follows: One station engineer, three engine men, three switch-board lads, also a jointer for outside work, who is capable of doing Gas Department work when his time is not fully taken up. Extra labour is got from men employed at the gas-works when required.

For the size of installation here described, a gas-engine driven station with producer plant using gas-works coke as fuel furnishes at the present moment the cheapest method of generating current for public supply. In the matter of fuel costs, it is worthy of note that our average figure—viz., 0·25d. per unit sold—is lower than the costs of any other station of similar output, and compares most favourably with steam-driven stations in large towns having a vastly larger output.

The Field for Gas and Electricity.

Let me remind you that the subject that is now before us is the supply of light, heat, and power to the public. How far is it possible to amalgamate the supply of the two forms of energy in the one company? In due time, an electricity supply will be required in many areas at present supplied by gas companies; and I venture to assert that, as business concerns, gas companies already established may very properly be looked to as the suppliers. In approaching a consideration of the subject, it will be well to clear the way from any possible bias or opposition in the minds of the suppliers of gas. Electricity for lighting is able to command a considerable share for domestic use. The question of cost is not necessarily considered—indeed, in many cases, not at all. From observation, I am able to state that electric light is preferred by an increasing number of people; and whether this is due to fashion or to merit need not concern us at the moment. It is worth while noting that public buildings of all descriptions are usually wired for electric light. For heating and cooking, the use of electricity is with difficulty finding a place; and its use in this way in our own area is almost *nil*. For this reason, the electric



The Three-Stage Tar Extractor.

prepayment meter has made slow progress, as the lighting demand alone does not provide sufficient revenue from the class of consumer to whom slot meters appeal. However, let it be said that electrical cooking and heating appliances, while expensive, are being sold in greatly increasing quantities by manufacturers. It is in the industrial use of electricity that the largest volume of business is to be done. For power it is recognized that the motor has its own special qualifications—ease of working, adaptability, and application to special conditions, as witness gas-works retort-houses.

I am convinced—and this point is of importance—that comparatively small towns of a purely residential kind do not meantime hold forth much hope of substantial business being done. This is especially the case where the gas company are alive to the best interests of gas consumers in providing facilities for the use of apparatus, and in giving personal attention to incandescent gas-burners. The mode of generation of electricity, where much capital has been sunk in moving machinery to meet the short-hour peak load in the winter months, and which would be largely idle in the daytime and during the long days of the summer months, makes the value of a day-load for the generating station of more value relatively than a day load for gas-works. Therefore an industrial community is undoubtedly the more favourable to larger output, and cheaper production of energy.

Advantages of Joint Supply of Gas and Electricity.

From my experience over a number of years, the joint supply of gas and electricity by the one company is a thoroughly practical proposition; and the evidence may be summarized. If the time is not yet ripe, gas authorities in many towns may find it to their advantage to create the opportunity, instead of being forestalled by another party, who, as a consequence, would be a competitor in the same field of business. There are engineering problems to be dealt with that are common; and there is a duty in serving the public to one common end. The cost of management is reduced, and establishment charges—such as clerical work and surveying of meters and collecting of accounts—can be done by the same staff. There would be removed the expense of the strenuous competition involved by both sides. Gas-works, as accessory to their chief work of producing gas, work-up residuals, and indulge in the business of supplying fittings and variety of gas apparatus. It is not a far step for them to go to make use of the gas, or the residual coke, wherewith to manufacture and distribute energy for light, heat, and power, as they have done all along, though a different kind of product, but which the public demand and insist on getting.

Financial Considerations.

As regards towns in Scotland working under the Burghs Gas Supply (Scotland) Act, 1876, a financial responsibility is imposed upon them by the Electric Lighting (Scotland) Act, 1891, which decrees that any loss resulting from the working of the electricity department of the corporation shall be met from the local rate, which is the gas-rate, or, in other words, the gas profits. Herein is seen an intimacy of interest in the financial working of gas and electricity works.

Results at Alloa.

The question will be asked, Does it pay? I make bold to assert that in very many cases the commercial knowledge and business experience of gas engineers provide justifiable assurance that the business can be made a financial success. The electrical engineer has put too much engineering into his works, and too little commercial knowledge, as witness the capital outlay involved in many electrical undertakings; and this has undoubtedly been the chief cause for deficits arising. In the case of Alloa during the years of the bulk supply contract, an annual deficit was shown of about £500. I have pointed out, however, that the terms arranged with the bulk supply company were against progress being made, and this is shown by the absurdly small output of current, taking into account the population of the district, and the power demand if rates were low enough. The present generating station was erected in 1910; and this year will see the output trebled under direct personal management, while it is confidently expected that, instead of a loss, there will be a slight profit. The output is still comparatively small, and can be greatly increased with the present size of plant.

Differential Charges.

We are not conscious of any collision of interests in meeting the wishes of consumers, whom we usually find well able to satisfy themselves as to this matter. The better class of residential property forms the bulk of the private consumers, together with a fair number of shops and public buildings. The major portion of the output of current is for motors; and this demand we are meeting with low rates compatible with making a fair profit. The rates for power are from 2d. to 0·9d. per unit, according to the quantity taken. The question is frequently asked how is it possible to sell current at low rates for power and defend the policy as being equitable and commercially sound. Our rate for lighting is 4d. per unit; and we have just concluded a contract with an engineering firm to supply current during the summer months only at 0·9d. per unit for power. With this price, let me at once state that a perfectly satisfactory aggregate profit will be made; also that any higher rate would not have obtained for us the business. The cost of production of each unit is made up of two items—the cost of generation and standing charges. The items under generation costs comprise fuel, water, oil, waste, &c., and the standing charges are salaries, wages, rent, taxes, interest, sinking fund, &c. A constant use of the running machinery is aimed at, and this can only be obtained by a motor load during the day; otherwise the plant, and therefore the capital spent, would be to a great extent standing idle. It follows that the costs of generation per unit will be unvarying no matter how many, or how few, units are generated. The standing charges affect the cost of production differently, inasmuch as the total charge from this source remains the same, and an increased output will have the effect of reducing the cost per unit under this head. Therefore, if we take the figure represented by works costs in our case (say) 0·4d. per unit (fuel, water, stores, and repairs), there is a substantial profit in selling a large quantity at 0·9d. per unit. I have assumed the wages to be a standing charge, as the number of men employed in our case cannot be decreased, and extra labour will not be needed. The profit thus yielded helps to meet the standing charges referred to, and the purely lighting consumer is benefited, who might otherwise be called upon to pay an increased price. The lighting consumer provides a short hour demand for a prescribed part of the year only, and the peak load must be met by excess capital and machinery for his needs.

The welfare of any gas company or corporation is, of course, intimately bound up with the interests of the communities that they serve; and if the demands of any community require the supply of electrical energy, then surely the concern already established to supply light, heat, and power should deem it their duty so to serve the public. That a Junior Association of Gas Managers should seriously discuss the question of electricity supply is evidence of the wide range of their proceedings, and a possible augury of the responsible work the members may be called upon to perform in the future.

DISCUSSION.

Mr. J. Napier Myers (Saltcoats) said that the paper recalled to his mind one by the late Mr. Denny Lane, of Cork, twenty years ago, which described the same policy, by means of gas-engines supplied from the mains of a city, and installations to be put down to generate electricity as required. He did not know that this policy had been carried out in any town. The only case that came to his mind was where a joint service of the kind had been adopted in Broughty Ferry, by establishing an electrical department within the walls of the gas-works. He rather thought it was not very successful; but for what reason he could not say. He believed, however, that it was put under different management afterwards. As a mechanical engineer, he would be disposed to favour the arrangement described. Those men who had studied, and were competent to generate gas at a profit, were, he felt sure, from the very circumstances, quite capable of collecting and distributing electricity. Electricity did not require to be made. It was there for the purpose of collection; and the process of collection and distribution was much simpler than the manufacture of gas. He had hopes that the young men around him were quite competent to undertake both duties; but the question began to shape itself in a political way. They might hesitate to embark upon a process because there was a fear that those who were being served by electricity would be apt, as they were now in many municipalities, to get their current below cost price—part of the burden of this being put upon the backs of the poorer gas consumers. They might fear that, with the joint service in the same hands, there might be a tendency to increase this burden.

Mr. W. Wilson (Falkirk), as one who suffered severe competition from a brother department run under the management of the same Town Council, said that he could echo the sentiments of Mr. Napier as expressed with regard to the desirability of having one control for the two departments. He might have been in the same position as Mr. Napier in the year 1905, when he was at Kirkintilloch. The Town Council had secured a Provisional Order for supplying electric current there, but did nothing with it. They endeavoured to sell it to one or two electrical supply companies; but when these companies learned the price of gas, they cried off. The Town Council were then faced with the difficulty of having their Provisional Order lapse. They considered the scheme again, and consulted an eminent engineer, who advised them to put down a generating station at the gas-works, and use gas-engines, very much as was done at Alloa. They had actual tenders in hand for putting down the generating station, and the Committee had selected the best offers; but when the matter was eventually laid before the Town Council, there was no support for the scheme. They had lost the Provisional Order, and were to-day in competition with electricity. One thing that struck him in Mr. Napier's paper was the way that he salved his conscience in giving cheap current and serving some consumers at the expense of others. He had been working out costs the other day in connection with an inquiry they had had from a large firm in the district. He approached the firm. They had two very large suction engines, and there was a possibility of him getting an increase of 5 per cent. in the annual output of gas. He worked the matter out. He took his costs of gas in the holder, and eliminated standing charges, and found he could supply them with gas at 3d. per 1000 cubic feet. He recommended the Town Council 1s. per 1000 feet; but he was sorry to say the Council were always rather led by the Electricity Department representatives. A Sub-Committee was then appointed, consisting of the Chairman of the Gas Committee and two representatives of the Electricity Committee. They had to put forward a price of 1s. 9d. per 1000 cubic feet for gas under 10 millions, and 1s. 6d.

above it. He would like to go on the same line as the Electricity Department, and cut them out where they could. The Electrical Department left no stone unturned to cut them out; there was a real competition. This matter would be solved entirely if they were under one management.

Mr. HENRY O'CONNOR (Edinburgh), said he had also made a note to refer to the suggestion of Mr. Denny Lane. He heard the paper he read upon the subject of introducing gas-engines about the town for the purpose of supplying electric light. It occurred to him, too, that Mr. Denny Lane was the real originator of the Parade system used in high-pressure lighting. He suggested laying down gas-engines for a row of shops, and supplying electricity. The suggestions that Mr. Napier had made certainly removed one of the great difficulties of both the gas and electricity suppliers. Everyone said the supplier of gas was biased in favour of his own commodity; but the electrician was also held to be biased on his side. If one person were selling both commodities, there could be no question of this bias. An important point to those who were not well up in electricity matters was the amount of loss in storing current. This was one of the great differences between electricity and gas; and he would like a figure regarding the matter from Mr. Napier. He could quite sympathize with Mr. Napier about the matter of his foundations upon the banks of a river. In one works where he was engaged in London, they had to carry the foundation down 30 feet. He had to drive about 10 miles of piles to sustain the buildings, at a cost amounting to about half-a-million sterling. He was glad Mr. Napier had mentioned the cost of the heating and cooking apparatus for using electricity. This was one of the greatest difficulties the electricians had to deal with. The cost of their apparatus was several times as great as that of similar appliances for using coal gas. He should like to add his thanks to those of other speakers for the excellent paper, bringing up the suggestion for joint supply. The question was one that would bear considerable thinking out by all of them.

Mr. JOHN WILSON (Falkirk) remarked that he saw Mr. Napier had managed to steer clear of the introduction of a Diesel oil-engine. He did not think this engine was as yet perfected. If the members could carry their minds back, they would recollect that the authorities of the Crystal Palace had sent out inquiries for illuminating their grounds by electric light. The Manager of the South Suburban Gas Company put in a tender to light the whole space with high-pressure gas, and also to supply gas-engines driving dynamos to give the electrical energy necessary for special cases; and he obtained the contract. He (the speaker) thought this was worth remembering. He would like to ask Mr. Napier if he had any difficulty in synchronizing the gas-engines when he was coupling them up.

Mr. JAMES M'LEOD (Greenock) wished to know if Mr. Napier would advocate dual control other than for medium-sized works. He knew that in Glasgow it was thought that the late Mr. Foulis would be able to manage both undertakings; but he declined to do so. In Greenock, Mr. Stewart was asked to take the dual control; he also refused. Dual control, except in a moderate-sized undertaking, would be much too great. He was interested in the question of the reduction of expenditure by having the two works conjoint. Capital expenditure did not seem to worry electrical engineers to any great extent.

Mr. JAMES M'GHEE (Glasgow) also had the feeling that, in a town any larger than Mr. Napier's, dual control would be rather a heavy burden for one man to face. He wished to congratulate Mr. Napier upon the admirable way in which his works were laid out, and upon the very good and low cost of production. It was within a fraction of Glasgow's cost for making electricity. If they took the general impression, there was in the air the feeling that small gas-works would be controlled from one centre, with the object of conserving cost; and there was a tendency towards carbonizing coal at the pit heads.

Mr. FULTON wished to know why Mr. Napier had installed producer-gas plant.

Mr. NAPIER, replying upon the discussion, said there were two lessons that gas engineers must learn upon electricity supply. In the first place, electricity had made great strides in the matter of efficiency and economy. It was also becoming very efficient for power purposes; and its use was more widespread than it was a number of years ago. It had undoubtedly a large future in the supply of light, heat, and power; and gas companies or corporations were the proper parties to take up the business. The other lesson which gas engineers might deduce from the experience of electricity departments was the extraordinarily low rate at which they were able to supply power. In Glasgow, the selling price was a little more than 3d. per unit, while for power it was a trifle over ½d. In Alloa, their selling price was 4d.; and they considered that, if there was a sufficient amount of business to be done, selling current at ¾d. per unit would yield sufficient profit. It was a matter for consideration whether gas engineers had not acted detrimentally to their interests in not having charged the public a lower price for gas for power purposes. He might say, in answer to Mr. O'Connor's question, that the loss in storage varied from 10 to 15 per cent. He quite agreed, as regarded dual management, that it was only possible where the works were of comparatively small size. As to the synchronizing of gas-engines, there was indeed a difficulty; but, so far, they had not found it necessary to run two engines at the same time. He had been asked why they did not use their own coal gas. One of the reasons was that the gasholder capacity at the works was not satisfactory, nor was the retort power. In putting down an electric station and taking upon one the responsibility of supplying electricity for a town, more especially one that was industrial, it was a matter of consideration how far one should "put all his eggs in one basket."

A Petrol Blow-Pipe Torch.

A handy little tool for heating soldering coppers, &c., is the "Imp" petrol blow torch, a sample of which has been forwarded for inspection by Messrs. Brown Bros., Limited, of Great Eastern Street, E.C. At the moment opportunity does not offer to give it a trial; but it may be said that it is simple in construction, and has every appearance of being well made for the purposes it is intended to serve—facts which go to substantiate the claim advanced on its behalf that it is absolutely safe and cannot get out of order. The torch, which comes from the United States, is almost of the "waistcoat-pocket" order, in the matter of size; and this, of course, is an advantage, if it proves as efficient as a large blow-lamp. There is no pump or valve, the action being entirely automatic. The blow-pipe can be started with a match; and it will burn for two hours at one filling. The torch has been designed to meet the many cases in which quick, clean, cheap, and intense heat is desired—by motorists and in numerous manufacturing operations. It is said to produce a perfect bunsen flame of over 2000° Fahr.; and the neck leading to the gas-outlet is corrugated so as to increase the heating surface and create a greater pressure than could otherwise be obtained.

Mr. Isaac Carr as Consulting Gas Engineer for Devonport.

At their meeting last Thursday, the Devonport Town Council went into committee to receive a special report from the Gas Committee. The Council sat in private for an hour-and-a-half. It is understood that Alderman Tozer, the Chairman of the Gas Committee, presented the special report, which arose out of a report upon the working of the undertaking made to the Committee on the 18th ult. When the reporters were again admitted, it was stated that the following resolutions had been passed: "That Mr. Isaac Carr, M.Inst.C.E., of Widnes, be appointed Consulting Gas Engineer, at a fee of 100 guineas per annum and £9 expenses for each visit, and that he be paid a commission of 2½ per cent. on the estimated cost of any new works entrusted to him by the Committee; the appointment to be determinable by six months' notice on either side." "That, on the recommendation of the Consulting Engineer, the whole of the retorts be reset with enlarged retorts, a modern pattern stoking machinery with telpher installed, and the necessary repairs and alterations to existing machinery carried out, at a cost of £7540; and that the cost, after appropriating the amount in hand for resetting retorts (£1878)—£5662—be provided out of the reserve fund."

Fletcher Moulton on Patents.

We have received from Messrs. Butterworth and Co., of Bell Yard, Temple Bar, a work on "The Present Law and Practice relating to Letters Patent for Inventions," by Mr. H. Fletcher Moulton, Barrister-at-Law, joint author of Roberts' and Moulton's "The Patent Act, 1907." It is one of the publishers' series of standard law books, one of which is the well-known "Michael and Will," and is got up in similar style. Mr. Moulton presents the law and practice in regard to letters patent as it stood at the close of last year; and in his preface he points out that though the basic principles of this law have remained unchanged, recent legislation has greatly affected the practice. The Patents Act of 1907 introduced many fresh problems for the practitioner, and some of the most important of them have not yet had the benefit of judicial elucidation. In these cases, the legal and practical applications of the new provisions have been discussed at length, with the view of assisting those who may have to advise thereon. The practice in the High Court has been fully treated by the author, who has also paid special attention to that of the Patent Office. Some suggestions have been added as to the method of drafting specifications. The text of the book is preceded by a valuable table of cases, and followed by an appendix containing the Act of 1907 already referred to. The book costs 30s.

We learn from the Hon. Secretary of the Manchester and District Junior Gas Association (Mr. J. Bridge, of Stretford) that arrangements have now been made for the members to visit the bye-product works of the Birchenwood Collieries next Saturday. By the courtesy of Mr. S. R. L. Allott (the Agent), the following works and plant may be inspected: The installation of 84 "Simon-Carvès" regenerative and waste-heat ovens, and bye-product recovery plant; 72 "Still" regenerative ovens, and the bye-product recovery, benzol rectification, sulphate of ammonia, carbolic acid, and pyridene plants; vertical and horizontal steam and gas engines, electric power-house, colliery headgear, conveying plant, &c.; and the largest Mond plant in existence, comprising 13 producers, &c. The underground workings may be inspected by a limited number of members arriving sufficiently early. This visit will be made in conjunction with the Manchester District Institution of Gas Engineers; and as this is the first occasion of the Senior and Junior Associations making a combined inspection of works, the Council hope as many members as possible will attend to render the gathering a record one.

GASEOUS HEATING.

By an Anonymous Author.

[A Paper read before the Yorkshire Junior Gas Association, April 12.]

The modern engineer, in whichever of the many branches of the profession he may be engaged, is being constantly faced with the problem of economically attaining in his furnaces and ovens a more or less high temperature, and in many cases of maintaining that temperature within almost infinitesimally small limits of variation for considerable periods of time. To none, however, is the problem likely to prove so intensely interesting as to the gas engineer; for not only in his own processes has the problem to be faced—in the satisfactory heating of his retorts—but by means of his staple product he is enabled to provide for other engineers a satisfactory, and in the majority of cases the most satisfactory, solution to this problem. It is becoming more and more realized that gas is a most handy, cleanly, and economical agent for generating heat, and that in ease of regulation it is not readily equalled.

The majority of fuels burn with a flame—a sure sign that the combustion is, in part at any rate, that of a gas. It is probable, therefore, that the use of gas as a heating agent outrivals the pyramids in antiquity; but it is only in comparatively recent years that gases have been specially manufactured as heating agents, and the scientific application of gaseous heating is of still later date.

The discovery and manufacture of coal gas by Murdoch, at the beginning of last century, was the first instance of fuel gases being specially manufactured. The earlier attempts at heating must have been somewhat crude, as the bunsen burner had not then been invented, and therefore of necessity a luminous flame must have been used. The invention of this burner, however, marks an important stage in the progress of gaseous heating, as all heating burners now used with coal gas work on Bünsen's principle. The late Mr. Thomas Fletcher, of Warrington, made a life-study of the atmospheric burner; and his firm (Fletcher, Russell, and Co.) brought it to a high state of perfection. Of late years the development of these burners has also been taken up by other well-known firms; and in many cases it is found advantageous to use the gas under a much higher pressure than was formerly the case.

Meanwhile, Sir William Siemens had been perfecting his system of producer-gas firing, and the recuperation of the waste heat, by which he effected surprising economies in the heating of steel furnaces. His pioneer work opened the way for the many systems in use at the present day.

It is not the author's intention, however, to write the history of gaseous firing, but to attack the subject from the point of view of the scientific principles involved.

Advantages of Gaseous Heating.

It will be as well to summarize here the chief advantages of gaseous over solid fuel. These are as follows; the exact order of their importance, however, varying considerably with the purpose for which the heat is required.

1. The superior thermal efficiency obtained. This is partly due to the more perfect combustion obtained with gaseous fuel, whereby the fuel can be completely oxidized with an extremely small excess of air. It is quite common practice to work gas-fired furnaces where the waste gases contain as little as 0·5 per cent. of free oxygen, whereas with a furnace using solid fuel it is considered good working if the waste gases do not contain more than 8·5 per cent. of free oxygen. When one considers that this means an excess of 70 per cent. of air—all of which enters the furnace cold and leaves it at a high temperature—it will be seen what a large proportion of the heat generated by the solid fuel is wasted in heating this excess air. In the case of gaseous fuel, too, it is an easy matter to arrange for the recuperation of a considerable proportion of the heat of the waste gases by allowing them to heat the incoming fuel gas and air. This further increases the thermal efficiency.
2. The greater convenience for exact regulation.
3. The greater ease in handling and distributing the fuel.
4. The greater cleanliness.
5. The reduction of wear and tear on the furnaces. This is due to the maintenance of an even temperature, the absence of cutting draughts, and the greater freedom of the furnace from fusible ash, which will act as a flux for the brickwork.
6. In many metallurgical operations it is of prime necessity that the material being heated should not be contaminated by such substances as sulphur and phosphorus. It is manifestly much easier to obtain gaseous fuel free from these substances than to get such a solid fuel.
7. The reduction in time generally found necessary for attaining the required temperature. This tends to economy in reducing standing charges and the wages of men waiting for the furnace to be ready.

That these advantages are becoming more widely known and recognized is evidenced by the fact that the use of gas for heating purposes is increasing at its present rate.

Gaseous Combustion.

The usual chemical equation set down to represent the combination with oxygen of any substance (say) methane [$CH_4 + 2O_2 = 2H_2O + CO_2$], is incomplete in not representing the whole of the story. The mechanism of the combustion is believed to be much more complicated than this; the oxidation being progressive and passing through the same steps that it does if carried out in the cold by a powerful oxidizing agent. The steps in the case of methane are: Methane, methyl alcohol, formaldehyde, formic acid, and then the final products, carbon dioxide and water,

$$2CH_4 + 4O_2 = 2CH_3OH + 3O_2 = 2CHOH + 2H_2O + 2O_2 = 2HCOOH + 2H_2O + O_2 = 2CO_2 + 4H_2O.$$

But this aspect of the case is not of very much interest from the point of view of our subject, as combustion is (or should be) quite complete before the gases leave the furnace; and it is consequently only the final products that matter. The chief lack of the usual equation is that it takes no account of the energy changes involved.

Each atom or molecule of a substance represented by its chemical formula possesses at each particular temperature a certain definite amount of energy. This energy is entirely the kinetic energy of the motion of the molecule and its constituent electrons. It is at present impossible to calculate its absolute value; but changes in its energy can be determined with considerable accuracy, and consequently a value assigned for the amount of this energy above some convenient datum. If, when so calculated, one side of an equation such as $CH_4 + 2O_2 = CO_2 + 2H_2O$ is found to represent more energy than the other, the difference will be liberated or absorbed—generally as heat energy—when the change takes place. Thus the complete equation should be

$$CH_4 + 2O_2 = CO_2 + 2H_2O + 211{,}840 \text{ calories}$$

if the resulting H_2O is condensed to water at the original temperature of the gases.

This equation is thermodynamically reversible. That is, if the change is made to take place in the opposite direction exactly as much energy will be absorbed as was liberated by the change shown. This is the case with all similar equations.

From the point of view of making engineering calculations, it is generally more convenient to know the energy change involved per pound or per cubic foot of the fuel used rather than employ the more scientific unit the "gramme-molecule." The amount of energy, expressed in suitable units, liberated by the combustion of 1 lb. or 1 cubic foot of a fuel is known as its calorific value.

Calorific Properties of Pure Gases.

The gases commonly used as fuels consist mainly of the same constituents in different proportions; and it will be well to glance at the calorific properties of these before passing on to the more complex mixtures. The accompanying table will show these. The

Table *Showing the Calorific Properties of Pure Gases.*

Substance.	Chemical Formula.	Density at N.T.P.			Weight of Products.		Volume of Oxygen for Combustion.	Cal. Value per Lb.		Cal. Value per Cub. Ft.		Calorific Intensity. Centigrade.
		$H_2 = 1$.	Air = 1.	Weight per Cub. Ft.	With Oxygen.	With Air.		Gross.	Net.	Gross.	Net.	
				Lbs.								
Carbon to CO	C	..	..	..	2·33	7·00	..	..	2,472	..	..	1285
,, CO_2	..	..	..	..	3·66	13·00	..	..	8,055	..	..	3380
Hydrogen	H_2	1	0·0695	0·0056	9·00	37·00	0·5	34,500	29,670	193	166	2190
Carbonic oxide	CO	14	0·972	0·0784	1·571	3·571	0·5	..	2,436	..	191	2385
Methane	CH_4	8	0·556	0·0448	5·00	19·00	2·0	13,240	12,033	595	540	1930
Ethane	C_2H_6	15	1·0415	0·0840	4·733	17·80	3·5	12,410	11,440	1042	961	1985
Propylene	C_3H_6	21	1·459	0·1176	4·428	16·426	4·5	11,367	10,633	1337	1255	2165
Acetylene	C_2H_2	13	0·9025	0·0728	4·077	14·847	2·5	12,144	11,772	884	857	2640
Benzene	C_6H_6	39	2·7075	0·2184	4·077	14·847	7·5	9,840	9,468	2180	2099	2145

Note.—Calorific values are in pounds × degrees C. units (= 1·8 B.Th.U.)

calorific values are in "pounds × degrees C." units, so as to agree with temperature calculations (Centigrade scale) which will be found in other parts of the paper. The values are those determined by Messrs. Mallard and Le Chatelier. In all calculations relating to combustion, the assumption is made that the air used contains 20 per cent. by volume of oxygen—an assumption which will probably be very near the truth when one remembers the kind of atmosphere from which the supplies for our furnaces are usually drawn, although analysis of the open air gives the oxygen content at 20·5 to 21 per cent.

It should not be necessary to explain to this Association the reason for the two values of the calorific power of gases containing hydrogen; the difference being due to the latent heat of the water vapour produced.

When high temperatures are required, it is important to study the calorific intensity of the gas employed. This figure is obtained by dividing the calorific value (net) of the fuel by the capacity for heat (weight × mean specific heat over temperature range expected) of its products of combustion. The result is a temperature range, the greatest through which it is theoretically possible to raise the products. There are many practical reasons for falling far short of the theoretical temperature attainable; but nevertheless the figure is a very suggestive one in indicating which fuels should be most suitable for high temperature work and giving an idea of the relative amounts of heat which would be lost in the waste gases.

In all temperature calculations for furnace work, it must be remembered that the specific heats of the gases which form the bulk of the waste gas increase enormously with the temperature.

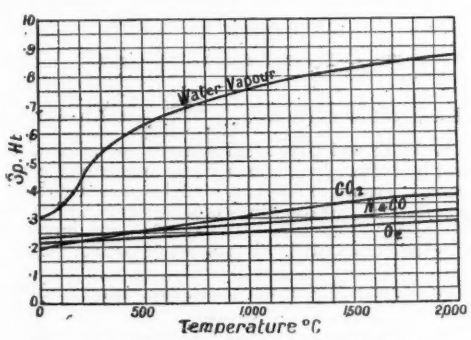


Fig. 1.—Specific Heat of Gases at Constant Pressure.

Fig. 1 shows graphically the variation with temperature of the specific heats of the common gases. It may be mentioned here that the specific heat of hydrogen is about 3·4, and is nearly constant. From the figure, it will be seen that it is manifestly unfair to accept low-temperature determinations of specific heat as representing the conditions in the interior of a furnace. This may account for the apparent discrepancies between the figures in the table and those in some engineering pocket books.

Fig. 2 gives the percentage composition and the calorific properties of the commoner fuel gases. Knowing the composition of any gas, its calorific properties may be calculated, though if feasible a more accurate value for the calorific power will be obtained by direct trial in a calorimeter than by analysis and calculation, owing to the lesser number of sources of error. As an example, the calculation of the calorific properties of the sample of coal gas is given.

Calorific Value per Cubic Foot.

Constituent.	Volume	×	Calorific Value.		Product.
Hydrogen	·479	×	166	..	79·51
Methane	·326	×	540	..	176·04
Olefines	·035	×	1255	..	43·92
Carbonic oxide	·061	×	191	..	11·65
Benzene vapour	·013	×	2099	..	27·29
			Total	. . .	338·41

This value is for dry gas at 15·5° C. and 30 inches barometer. As usually supplied, however, gases are saturated with water vapour, the tension of which at 15·5° C. is 0·517 inch of mercury. The calculated value of the calorific value must be corrected by multiplying by the factor

$$\frac{(\text{Barometric Height} - \text{Vapour Tension of Water}) \times 288{\cdot}5}{30 + (\text{Temp.}^\circ\text{ C.} + 273)}$$

for other temperatures and pressures.

Air Required for Combustion.

Constituent.	Volume.				Oxygen Required.
Hydrogen	·479	×	0·5	..	·2395
Methane	·326	×	2·0	..	·6520
Olefines	·035	×	5·0	..	·1575
Carbonic oxide	·061	×	0·5	..	·0305
Benzene vapour	·013	×	7·5	..	·0975
					1·1770
Less oxygen in gas					·002
Net oxygen required					1·175

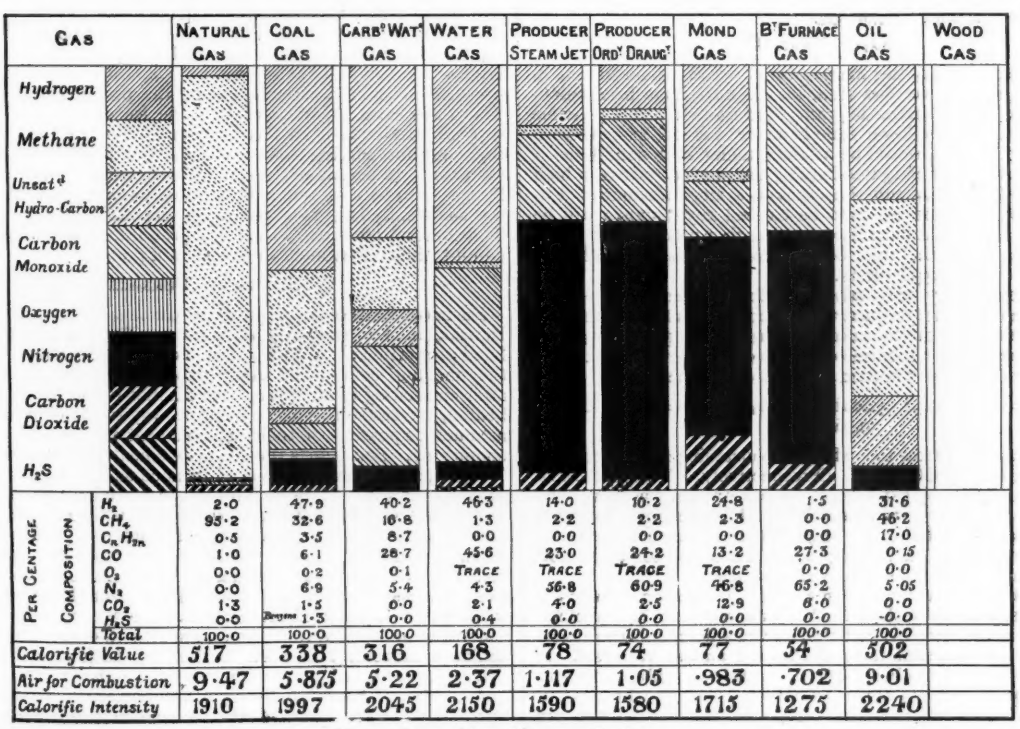
Air required 5 × 1·175 = 5·875 volumes.

Calorific Intensity.

Constituent.	Volume.	Volume of Products Produced. H_2O.	CO_2.	N_2.
Hydrogen	·479 ..	·479	—	—
Methane	·326 ..	·652	·326	—
Olefines	·035 ..	·105	·105	—
Carbonic oxide	·061 ..	—	·061	—
Benzene vapour	·013 ..	·039	·078	—
Carbon dioxide	·015 ..	—	·015	—
Nitrogen	·069 ..	—	—	·069
Air for combustion	5·875 ..	—	—	4·700
Totals		1·275	·585	4·769

There are thus produced by the complete combustion in air of 1 cubic foot of this coal gas, 1·275 cubic feet of water vapour, 0·585 cubic foot of carbon dioxide, and 4·769 cubic feet of nitrogen—the products being measured under the same conditions of temperature and pressure as was the original gas.

Comparing the gas with the properties of its constituents, it will be seen that its calorific intensity should be about 2000° C. For this range, from ordinary temperatures, the mean specific heats of water vapour may be taken as 0·7; of carbon dioxide, as 0·3; and



Per Centage Composition	Natural Gas	Coal Gas	Carb° Wat° Gas	Water Gas	Producer Steam Jet	Producer Ord° Draug°	Mond Gas	B° Furnace Gas	Oil Gas	Wood Gas
H_2	2·0	47·9	40·2	46·3	14·0	10·2	24·8	1·5	31·6	
CH_4	95·2	32·6	16·8	1·3	2·2	2·2	2·3	0·0	46·2	
C_nH_{2n}	0·5	3·5	8·7	0·0	0·0	0·0	0·0	0·0	17·0	
CO	1·0	6·1	28·7	45·6	23·0	24·2	13·2	27·3	0·15	
O_2	0·0	0·2	0·1	TRACE	TRACE	TRACE	TRACE	0·0	0·0	
N_2	0·0	6·9	5·4	4·3	56·8	60·9	46·8	65·2	5·05	
CO_2	1·3	1·5	0·0	2·1	4·0	2·5	12·9	6·0	0·0	
H_2S	0·0	Benzene 1·3	0·0	0·4	0·0	0·0	0·0	0·0	0·0	
Total	100·0	100·0	100·0	100·0	100·0	100·0	100·0	100·0	100·0	
Calorific Value	517	338	316	168	78	74	77	54	502	
Air for Combustion	9·47	5·875	5·22	2·37	1·117	1·05	·983	·702	9·01	
Calorific Intensity	1910	1997	2045	2150	1590	1580	1715	1275	2240	

Fig. 2—Composition of Common Fuel Gases.

of nitrogen, as 0·275. Then the heat capacity of the products is as follows:—

Constituent.	Volume	× Lbs. per Cub. Ft.	× Sp. Heat.	
Water vapour	1·275	× 0·05404	× 0·7	= ·04498
Carbon dioxide	·585	× 0·1232	× 0·3	= ·02162
Nitrogen	4·769	× 0·0784	× 0·275	= ·10282
Total				·16942

$$\therefore \text{Calorific intensity} = \frac{338{\cdot}4}{{\cdot}16942} = 1997^\circ \text{ C.}$$

This value would, of course, have to be corrected if necessary by allowing for the water vapour in the coal gas and in the air for combustion.

Fuel Gases.

On examining the gases given in fig. 2, it will be seen that they can be roughly divided into two classes—those which are made specially for, and in conjunction with, the furnace to be heated; and those made some distance away by a separate plant or process and distributed for more or less general use. Most of the producer gases belong to the first class, while coal gas, blue and carburetted water gas, and Mond gas belong to the second. By far the greater proportion of large furnaces are heated by producer gas; and as the gas production is generally under the same control as the furnace, it will not be out of place here to consider the production of

Producer Gas.

Although slight modifications are introduced by variations in the fuel used, all gas "producers" depend fundamentally on the fact that carbon is capable of forming two oxides—carbonic oxide (CO) and carbon dioxide (CO_2), both of which are gases; the lower oxide (CO) being a valuable fuel. It is the aim therefore of a gas producer to form this rather than the higher oxide.

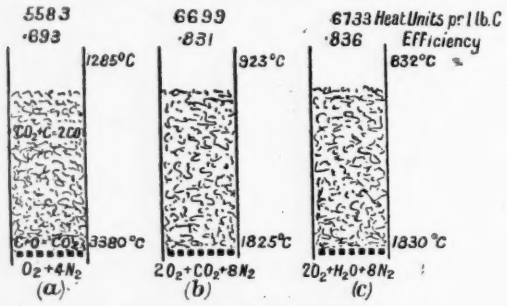


Fig. 3.—Action of Producer.

Fig. 3 (*a*) shows diagrammatically such a producer. The fuel which consists mainly of carbon, is supported on a suitable grate, and air is allowed to enter under the grate and to traverse the incandescent carbon. It is almost certain that in the first stage, which takes place in a narrow zone close to the grate, the carbon is burnt to the dioxide

$$C + O_2 = CO_2$$

and that as the CO_2 passes upward through the incandescent carbon, the CO_2 is reduced to CO

$$CO_2 + C = 2\,CO$$

On this assumption, the temperatures which would obtain in these zones, if there were no other loss of heat, have been calculated and are figured on the diagram; and while in actual practice the temperature in the lower zone is never realized, temperatures approaching 2000° C. would be attained under such conditions.

It will be seen that the gases leaving the producer are at a high temperature (1285° C.), and thus contain a large amount of sensible heat, which if the gas is to be carried any distance will be lost. Indeed, the calorific efficiency of such a producer would be only 69·3 per cent.; the calorific value of the gas obtained from 1 lb. of carbon being 5583 units.

It would manifestly be an advantage to cause less sensible heat to be generated in the producer itself, and to therefore leave more energy to be carried as the calorific value of the producer gases. Two reactions suggest themselves, both of which are endothermic and capable of carrying heat in the desired manner

$$CO_2 + C = 2CO - 37{,}332 \text{ cals. and } H_2O + C = H_2 + CO - 39{,}366 \text{ cals.}$$

Fig. 3 (*b*) and (*c*) show the effect of consuming 20 per cent. of the total carbon, by CO_2 and H_2O respectively. The theoretical zone temperatures are (as before) figured on the diagram. The increase in efficiency is most marked; while the immense practical importance of the lower temperatures in the producer will be readily recognized, as leading to a reduced cost for brickwork renewals, and to the easier removal of clinkers.

Theoretically CO_2 control, owing to the lower specific heats of the products, can be pushed further and result in higher efficiencies than steam control; but the immense practical advantages of the latter are sufficient to render its use almost universal. It is extremely difficult to obtain CO_2 in a state of sufficient purity for this purpose; and in the cases which have been brought to the author's notice where waste gases (containing at most 20 per cent. of CO_2) have been injected by steam into the producer, the process has been ultimately abandoned.

It may be thought here that it is merely a question of supplying sufficient steam to raise the producer efficiency to any desired extent; but in a producer where heat efficiency is of primary importance, and secondary reactions such as those which form such a feature of Dr. Mond's process are not desired, an upper limit is reached when about one-fifth of the carbon is being consumed by the steam—corresponding to the state shown on fig. 3 (*c*), for the reason that the process represented by the equation

$$CO_2 + C \rightleftarrows 2\,CO - 37{,}332 \text{ cals.}$$

is a thermodynamically reversible process—its equilibrium depending on the temperature.

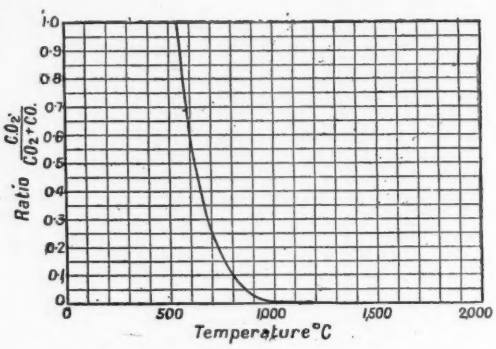


Fig. 4.—Equilibrium of $CO_2 + C = 2CO$.

The relation between the ratio $\frac{CO_2}{CO + CO_2}$ and the temperature is shown in fig. 4; and this equilibrium is not affected to any great extent by ordinary variations of pressure, or by the presence of inert gases. From the diagram, it will be seen that at temperatures above 1000° C., the resulting gas consists mainly of CO; but that as the temperature falls below 1000° C., the proportion of CO_2 rapidly increases, until at 540° C. practically no CO is formed.

It will thus be seen that to work with temperatures of less than 800° C. in the final zone means that the resultant gas will contain a considerable percentage of CO_2, with a corresponding loss in efficiency. In an ordinary producer, the loss of heat due to radiation, ash, &c., is seldom less than 8 per cent. of the heat actually generated in the producer. Allowing for this, the temperature of the upper zone of a producer burning 20 per cent. of its carbon by means of steam would be about 780° C.—corresponding to a producer gas containing about 5 per cent. of CO_2.

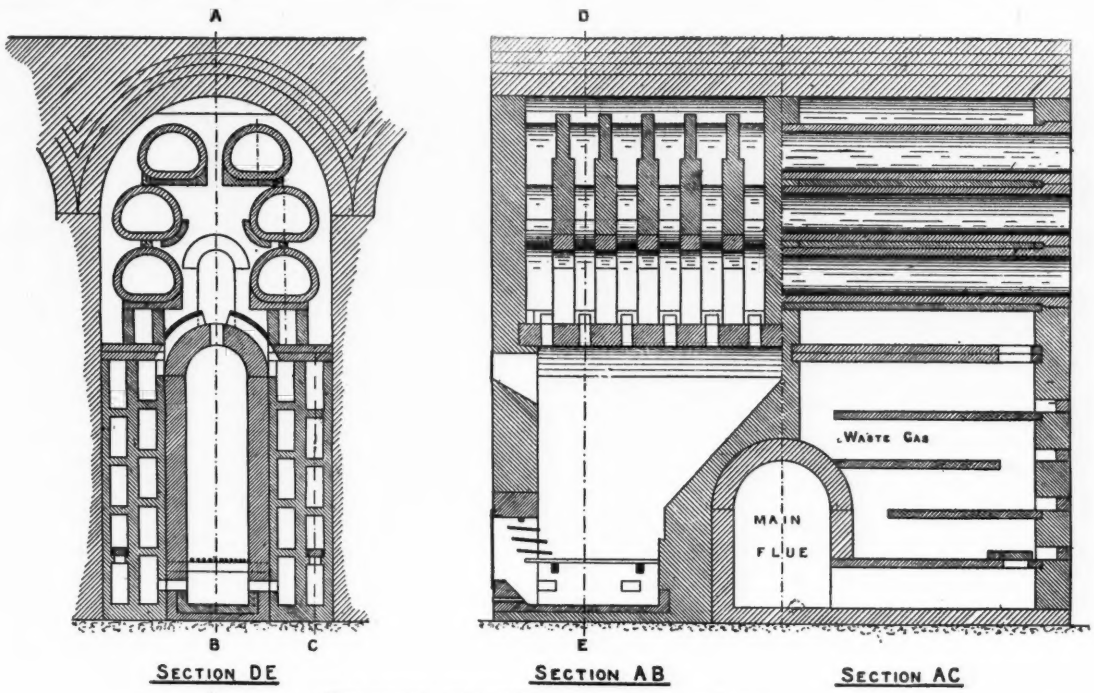
It may be interesting here to note that producers burning coke of good quality or anthracite may be expected to gasify about 18 lbs. of coke or 24 lbs. of anthracite per hour per square foot of grate area.

Large producers use bituminous coal for fuel. A very successful form is the Duff-Whitfield. In this producer, which has an open bottom sealed in a water trough, the fuel rests on the bed of clinker, which is removed as required through the water seal. Air driven by a steam-jet injector is admitted under the conical "grate" from which the clinker slides as formed. Poker holes are provided, so that the fire can be poked, and the clinker broken up when necessary, without putting the producer out of action. There are extra injectors at the side for drawing off the tarry vapours produced from the "carbonization" of the bituminous fuel and for forcing these through the fire, where they are "cracked" to permanent gases. These are not necessary when the gas is to be used purely for heating purposes and the travel is not sufficiently long to allow of the deposition of the "tar fog." The thermal reactions in such a producer are too complex to admit of fuller treatment in the present paper.

Producer-Gas Furnaces.

Furnaces for the use of producer gas are of very varied forms. In principle, however, they are similar. The air and gas in regulated proportions are admitted to a combustion chamber, where they mix and combustion takes place. The resultant hot gases, after circulating in an appropriate manner round the object to be heated, traverse a regenerator on the way to the chimney, where as much as possible of their sensible heat is given up to the incoming air. Sometimes the gas also is heated in this manner.

Figs. 5 and 6 show the type of furnace usually adopted to heat coal-gas retorts. In these furnaces, the producer is usually incorporated within the furnace, and is fed with coke drawn red-hot from the retorts. The gas, hot from the producer, passes through "nostrils" in the producer arch into the combustion chamber, where it meets streams of highly-heated secondary air from the regenerator. After circulating round the retorts, the waste gases—then at about 1100° C.—are passed down this regenerator on their way to the main flue and the chimney. A similar arrangement is used for heating large annealing ovens. Where furnaces are used with gas from outside producers, the producer is, of course, omitted, and a horizontal regenerator is fitted in the lower part of the furnace, in which the producer



Figs. 5 and 6.—Typical Furnace for Heating Gas-Retorts.

gas, as well as the secondary air, is heated before entering the combustion chamber.

In designing these furnaces the following points must be borne in mind:

(*a*) Suitable refractory material must be selected, capable of withstanding the high temperatures to which it will be heated.

(*b*) The gas and secondary air must enter the combustion chamber, heated to as high a temperature as possible, and should enter close together in parallel streams, so that mixing is thorough but not too violent.

(*c*) Unless an intense local heating is desired, the combustion chamber should be of ample capacity, and so arranged that the gases are not compelled to move with a high velocity until they have parted with a good deal of their heat. Otherwise, what is known as a "cutting draught" is produced, and the high velocity flame, charged with fusible dust from the ash in the fuel, rapidly fluxes the brickwork. The rapidity with which combustion takes place depends on the degree of intimate mixture of the gases; and combustion is thus accelerated by the eddies caused by the rapid motion of the gases. The speed with which heat can be transmitted to the brickwork also depends on the velocity with which the gas passes over the surface, and on the same eddying action. The effect is therefore cumulative. The author is convinced that many of the failures which occur in combustion chambers are due more to faulty design than to inferior material being used.

(*d*) Exit flues should be of ample size, and regulating dampers should not be placed in positions where they will be exposed to high temperatures.

(*e*) Provision should be made for clearing out the dust which accumulates in the flues, and access should be provided so that cracks in the brickwork (which will develop even with the best designs) may be repaired without interfering with the working of the furnace.

(*f*) The steelwork bracing should be carefully arranged, so as to support primarily those walls in which cracks would seriously affect the regulation of the furnace.

Regenerators.

These are for transferring to the air and gases entering the furnace as much as possible of the sensible heat of the waste gases. They are of two types: (*a*) Counter-current, and (*b*) Siemens.

Type (*a*) is a continuously acting device, in which the air or gas to be heated passes through a flue, or series of flues, round which the waste gases are allowed to circulate in a direction opposite to that of the air. These flues need be neither long nor tortuous. The rate at which a gas will pick-up heat from a hot surface, provided that the gas is made to come into intimate contact with the surface, is almost incredible; and so far as transmitting heat to the air goes, there is no need for the many elaborate baffles devised to give the air a long travel so commonly met with. The problem of efficient regenerator design, then, so far as merely heating the air goes, resolves itself into the bringing of the air into intimate contact with the hot brickwork, as air is not perceptibly heated by the passage through it of radiant heat.

The most important thing is to arrange that the heat can be conducted from the waste gases through the brickwork as fast as the air is capable of picking it up. The heat conduction can be accelerated by: (*a*) Increasing the area of the brickwork conducting, or (*b*) decreasing the thickness of the divisions between the waste gas and air. It is in the direction of (*b*) that most of the recent improvements in regenerator construction have been made; and the author knows of one such regenerator dealing with about 50,000 cubic feet of air per day, and heating it to from 1000° C. to 1050° C., which consists of a fire-clay tube 18 inches by 1 inch cross section and about 8 feet long. When this is compared with the usual flue, about 15 inches by 7 inches and 30 feet long, it will be seen that a distinct improvement is possible in the older types of regenerators. The reduction in the area of the division wall, with the consequent lessened chance of cracks, will appeal to those members who have been troubled with "short-circuiting" in the regenerator.

In the Siemen's regenerator, two chambers are employed. These are filled with chequer brickwork, and are so connected to the furnace by means of flues and dampers that the waste gas and air pass alternately through these chambers—the air passing through the chambers in the opposite direction to the waste gas. Thus while the waste gas is giving up its heat to the chequer brickwork in one chamber, the air is abstracting the heat previously left by the waste gas in the other chamber, and *vice-versâ*. This type of regenerator is only used on the larger furnaces.

Regulation of Furnaces.

Suitable air and gas dampers or valves are fitted to the furnaces for the purpose of regulating the chimney draught and the proportions of air and gas entering the furnace. As regards the chimney draught, the golden rule is to work with as little pull as possible, consistent with maintaining the required temperature in the furnace.

Although experience teaches us to regulate the proportions of air to gas successfully by an inspection of the flues, by far the surest guide to this is an analysis of the waste gases. In taking the sample, due regard must be given to any variations in the rate of gas production due to clinkering over of the generator; and the best place from which to take the sample is the flue immediately after the gases have left the furnace, so that the sample is not contaminated with air introduced by short-circuiting if such exists.

The amount of CO_2 found in the gases may be affected by the quality of fuel used in the producer; and the surest guide is the quantity of free oxygen, which for successful working should be 0·1 to 0·5 per cent. by volume. If more is found, or if any fuel gas is detected, the slides should be readjusted. A simple proportional calculation of the amount of air deficient or in excess will generally enable the correct adjustment to be made at once.

Heating by Coal Gas.

For small furnaces, it is not generally economical to instal producers; and the use of coal gas for this class of work is daily extending.

The days of heating by luminous flames are over, except in some types of radiators and water circulators where a very great range of adjustment is required, and for furnace work the atmospheric

burner is universally used. As great improvements are constantly being made in this class of burner, it will be well to consider its construction. As invented by Bunsen, the burner consists of a brass tube about ⅜ inch diameter and 6 inches long, provided at the bottom end with transverse holes for the admission of air. Into the bottom end of the tube is fixed a small jet, through which gas at the ordinary supply pressure is allowed to enter the tube; and by its injector action it draws in with the gas a supply of air, the amount of which can be regulated by a sliding sleeve.

The alteration in the character of the flame as more and more air is admitted is well known; the following stages being clearly marked:—

(*a*) No air. The flame is flickering, unstable, and smoky.
(*b*) As air is increased the flame, though still flickering gradually, decreases in size, loses its luminosity, and becomes blue or violet.
(*c*) As more air is admitted, the flame still further decreases in size; and a distinct inner blue cone is seen to form, the rest of the flame being purple.
(*d*) On further increase of air, the size of the flame still further decreases. The inner cone becomes bright green, and the outer cone assumes a redder tint. With most burners the flame is now noisy; and on an ordinary bunsen burner any further increase of air will cause the flame to "fire-back." If, however, steps are taken to prevent this, further increases of air cause the following changes:—
(*e*) The inner cone flattens down, and becomes bright blue. The outer cone is now much smaller and is red.
(*f*) By now increasing the air sufficiently, the outer cone can be made to disappear altogether, and the flame (which will not keep alight in the open air) appears bright blue.

The stages may be taken to represent the following degrees of aëration of the gas mixture.

(*a*) No air.
(*b*) Air sufficient to oxidize to CO the carbon of the illuminating hydrocarbons; these being fully attacked before the appearance of the inner cone.
(*c*) (*d*) The change in colour of the inner cone from blue to green indicates that some of the carbon is being oxidized to CO_2, and that some of the methane is being attacked in the inner cone. At this stage, it is possible, by means of Smithell's cone separator, to separate the two stages of combustion. The spectrum of this inner cone is peculiarly interesting, as it is neither that of an incandescent solid nor of a perfect gas. The former is a continuous band of colour, while the latter consists of isolated lines. The spectrum of this inner cone consists of a number of broad bands, the "red" ends of which are quite sharp, while towards the violet they fade to darkness.
(*e*) The blue colour of the inner flame indicates that practically all the carbon is being partially oxidized there along with some of the hydrogen; the outer flame consuming a mixture of CO_2, H_2O, H_2, CO, and N_2.
(*f*) The whole of the gas is being burnt in one stage, corresponding to theoretically perfect combustion with full aëration.

In most modern high temperature gas-furnaces stage (*f*) is realized. But, as previously stated, with the ordinary bunsen burner, it is very seldom that stage (*d*) is passed, as the burner will "fire-back"—the offensive smell of the partially oxidized hydrocarbons being well known.

The reason for the firing-back is that the combustion has become so intense that the velocity of propagation of a flame in the mixture—*i.e.*, the speed with which it burns—has become greater than the velocity of the mixture in the burner-tube. The flame consequently travels down the tube against the gas current. The velocity of the flame is affected by a good many circumstances. If the flame once gets a "start," so that it sets up a pressure wave of detonation in the mixture, the flame will travel with the velocity of sound—*i.e.*, at about 3000 feet per second in ordinary gas mixtures; but for steady burning, the critical "firing-back" velocity depends on

(*a*) The "richness" of the mixture;
(*b*) The nature of the combustible gas. The velocity is highest with hydrogen, and decreases as the density of the combustible gas increases;
(*c*) The rate at which heat would be abstracted from the flame were it to fire-back. This will obviously be affected by the tube diameter, and by the presence of gauze screens or similar obstructions.

Fig. 7 shows how it may be expected to vary with ordinary coal gas and air mixtures; the lower curve being drawn from results by Professor Strache, of Berlin, for a ⅜-inch bunsen tube, and the upper one from experiments on a ⅞-inch tube by the author.

Essential Conditions for the Success of an Atmospheric Furnace Burner.

(1) It must take into the furnace only sufficient air to ensure that combustion is complete. It is not necessary that this air should all be injected along with the gas entering the burner. Indeed, with the ordinary pressure atmospheric burner this is impossible, and a secondary supply of air is imperative. But it is manifestly easier to regulate a furnace having only one air supply; and when an ideally aërated mixture is used, much higher temperatures are possible than when the combustion takes place in two stages.

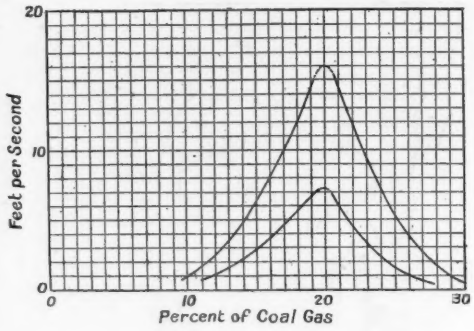


Fig. 7.—Velocity of Propagation of Flame.

(2) The gas mixture should be homogeneous. Failure to obtain proper mixing results in a noisy burner, from the fact that variations in the richness of the mixture produce corresponding variations in the size of the flame, and this gives rise to sound vibrations.
(3) The gas mixture must be injected into the furnace through the burner nozzles at a velocity greater than the firing-back velocity.

Furnaces using coal gas may thus be of two main types: (1) Furnaces where two air supplies, primary and secondary, are needed. (2) Furnaces where the whole of the air necessary for combustion is injected through the burner along with the gas. Type (2) is now becoming more widely used, and for high temperature work is now employed exclusively. To inject into a furnace an ideally aërated gas mixture through a ⅞-inch tube a velocity of at least 16 feet per second is necessary to prevent firing-back; and the author's experience leads him to believe that a velocity of 28 feet to 30 feet per second is desirable to overcome such disturbing influences as hot burner-tubes or shocks to the flame. With commercial types of injectors, it is impossible to attain such velocities and mixtures with gas at the ordinary supply pressure, and the additional energy required is obtained by supplying either the gas or the air at a higher pressure.

High-Pressure Gas.

In the author's opinion high-pressure gas has many advantages over high-pressure air for this work. The principal advantage lies in the ease of adjustment and control. Once the burners are regulated, it is merely necessary to keep the gas pressure at a predetermined figure to ensure temperatures being obtained or maintained as the case may be, and as the burners are self-adjusting over a wide range of pressure, a workman can with very little training successfully look after several furnaces. Given suitable design of burners and furnace, results can be obtained which cannot be surpassed by the most skilful use of pressure air.

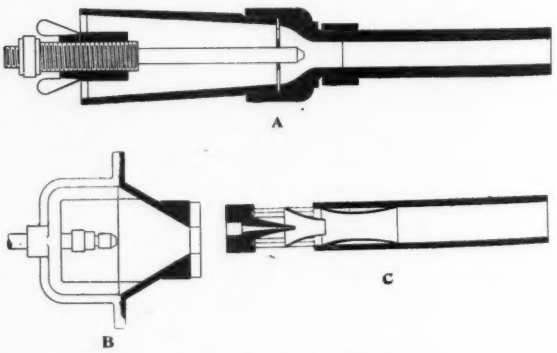


Fig. 8.—High-Pressure Gas-Burners.

Fig. 8 shows several types of high-pressure gas-burners. A is the Onslow heating burner. B is the Smith-Walter heating burner. C is a burner designed by the author, which is giving excellent results.

Most injectors now in use are extremely inefficient as air injectors. There will manifestly be a great loss of energy when a jet of gas with a velocity of about 500 feet per second is mixed with air that is practically stationary; but there should be no loss of momentum. Taking 30 feet per second as a desirable velocity

for the gas mixture, we have as the momentum of a quantity containing 1 cubic foot of gas —

1 cubic foot gas at ·0408 lb. per cubic foot . . = ·0408
5·875 cubic feet air at ·0806 lb. per cubic foot . = ·4735

Weight . . . . . = ·5143 lb.

$$\therefore \text{Momentum} = \frac{\cdot 5143 \times 30}{g} \text{ corresponding to a velocity of}$$

$$V = \frac{\cdot 5143 \times 30}{\cdot 0408}$$

$$= 378 \cdot 1 \text{ feet per second for the gas.}$$

This is equivalent to a head H of gas

$$H = \frac{V^2}{2g}$$

$$= \frac{378 \cdot 1^2}{64 \cdot 4} \text{ corresponding to a pressure of}$$

$$P = H \times W$$

$$= \frac{378 \cdot 1^2 \times \cdot 0408}{64 \cdot 4} \text{ lbs. per sq. foot.}$$

$$= \frac{378 \cdot 1^2 \times \cdot 0408}{64 \cdot 4 \times 144} \text{ lbs. per sq. inch.}$$

$$= \cdot 6304 \text{ lb. per sq. inch.}$$

When it is remembered that, by suitably proportioning the gas and air passages, the loss of energy allowed for in the above calculation can be much reduced, and that the usual pressures at which high-pressure gas is supplied for furnace work vary between 3 lbs. and 12 lbs. per square inch, it will be seen what room there still is for improvement in the design of high-pressure gas-burners.

Air-Pressure Burners.

In skilled hands this system gives excellent results. In the author's opinion, however, it has one grave defect—that, unless the gas supply be carefully governed for each furnace, the lighting-up of other furnaces, or burners even, will upset the regulation of the burners already working and so reduce the efficiency of the furnace. Also the burners are anything but self-adjusting, and require a good deal of attention.

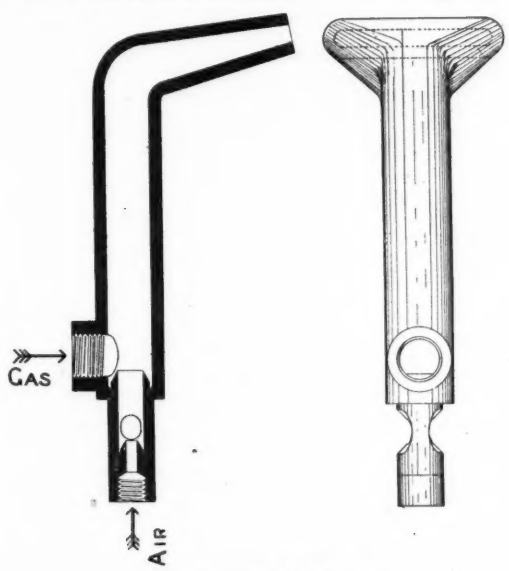


Fig. 9.—Pressure-Air Burner.

The usual type of burner is shown in fig. 9. Air at a fairly high pressure is used in a double injector, the jet drawing in a supply of air from the atmosphere, which mixes with the pressure air and is carried forward into the injector tube proper of the burner.

Some types of air pressure burner, where the whole of the air used is compressed to but a low pressure, have the disadvantage that if the air supply (usually from a fan) fails, the gas may find its way down the air-pipe and an explosion result.

Crucible and Muffle Furnaces.—See Figs. 10, 11, 12.

Furnaces using pressure air or pressure gas are of similar design, with the exception of the actual burners. The general points to be borne in mind in their design may be summed up as under :—

(*a*) The gas mixture from the burner should impinge tangentially upon a firebrick surface. If this is scored or indented slightly, it will greatly assist the combustion—more especially when lighting up.

(*b*) The rate of combustion of such a gas mixture is extremely high; and as the rate of transmission of heat from the gas to the fireclay surface depends greatly on the velocity of the gas, the combustion space should be kept small and the gas velocity high. In small furnaces $\frac{1}{2}$ inch is sufficient to allow between a crucible or muffle and its furnace casing, while in the largest furnaces $\frac{3}{4}$ inch to 1 inch is ample, unless of course some practical consideration of the furnace construction demands more space. For instance, for heating cast-iron muffles or containers, sufficient space must be allowed for the well-known "growing" of cast iron under continued heating.

(*c*) The gas passages should be arranged to secure the required heat distribution, and care should be taken to see that they do not short-circuit to the flue. In most cases, however, solid baffles are unnecessary, as the inertia of the gases issuing from the burner is sufficient to keep them in the desired path.

(*d*) If only comparatively low and even temperatures are required in the muffle, a combustion chamber must be provided, and the floor of the muffle partially shielded from direct contact with the most intense combustion. The author has secured this result in the manner shown in fig. 12.

Oven Furnaces.

Two methods are in common use for heating these furnaces. In the first, the oven is provided with a false floor covering the combustion chamber. The waste gases escape through apertures in this floor near the sides of the furnace and leave the furnace

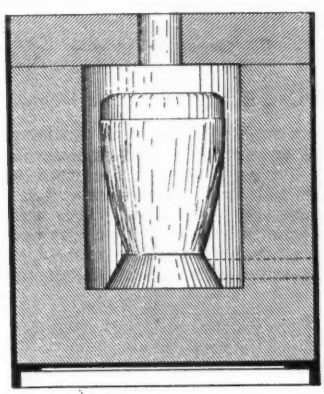


Fig. 10.—Crucible Furnace.

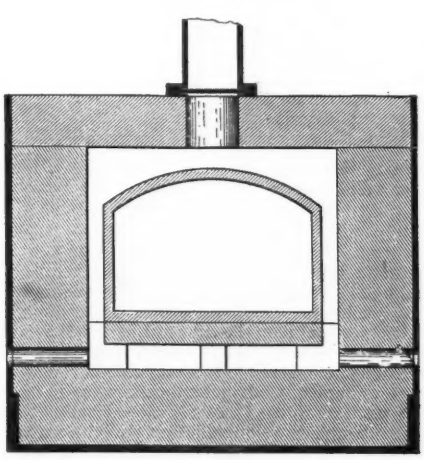


Fig. 11.—High-Temperature Muffle Furnace.

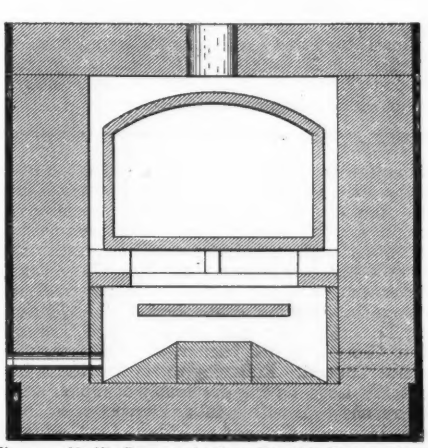


Fig. 12.—Muffle Furnace for Low Equable Temperatures.

by a flue in the roof. In the second (which the author believes is a patent of Mr. S. N. Brayshaw, of Manchester), the oven has a solid floor and the gas mixture is injected from the top—see fig. 13. The advantage of a solid floor is too obvious to need comment, while the position of the burners renders them peculiarly free from liability to become choked.

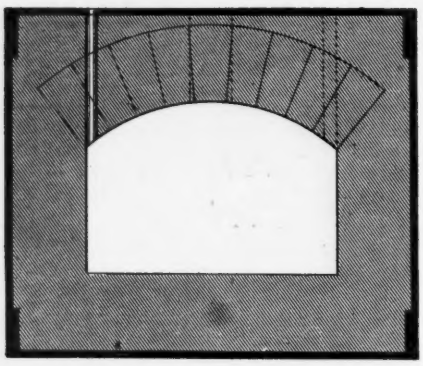


Fig. 13.—Oven-Furnace.

Amount of Gas Required to Heat-up a Furnace.

When designing gas-heated furnaces, the temperature of the furnace and the time taken to reach that temperature from cold are imposed by the conditions of the work of the furnace. Before the burners and combustion chamber can be designed, it is necessary to know how much gas will be consumed.

For those who wish to go deeply into the subject, the following formulæ may be given, for the temperature θ in the wall of a furnace, x feet from the inner wall, and t seconds from the commencement.

$$\theta = \theta_1 - (\theta_1 - \theta_2)\,\frac{x\,(1 + cX)}{K(1 + cx)} - (\theta_1 - \theta_3)\,e^{-\frac{2kt}{KDx^2}}$$

where θ_1 = furnace temperature
θ_2 = final temperature of outer wall after a very long run
θ_3 = original temperature of brickwork and room

$$c = \frac{\sqrt{A_1} - \sqrt{A_2}}{\sqrt{A_2} \times X}$$ where A_1 is the outside area and A_2 the inside area of the furnace wall

X = thickness of wall
K = specific heat of wall
k = thermal conductivity of wall
D = density of wall
e = base of Napieran system of logarithms

θ_2 can be calculated from the following formulæ if the emissivity E of the outer wall is known.

$$\theta_2 = \frac{E\ A_1\ (\theta_2^4 - \theta_3^4)}{A_2\,k\,c\,(1 + c\,X)}$$

An approximate method is as below: Estimate the quantity of heat required by allowing for heating-up the contents of the furnace, any trays or muffles used, and a thickness of about 1½ inches of the firebrick surrounding the furnace, from the room temperature to the furnace temperature, and then add 5 to 10 per cent. to allow for radiation. Calculate the available heat per cubic foot of gas by subtracting from the net calorific value the amount of heat carried away by its waste gases if these leave at the furnace temperature. A simple division will then give the amount of gas required, from which the burner consumption can be readily calculated.

Such a paper as this would be incomplete without reference to Dr. Bone's system of gaseous heating; but the author feels that the ground has been so recently and so completely traversed by Dr. Bone himself that any remarks of his would be in the nature of "carrying coals to Newcastle." He begs, in conclusion, to express the hope that the subject has not proved uninteresting, and that the paper will provoke a good discussion.

Gas Managers as Councillors.—At the election of members of the Formby Urban District Council on Monday last week, Mr. J. Howgate Buckley, the Manager of the Formby Gas Company, Limited, was the successful candidate for representing the Duke Street Ward. He secured 139 votes, against 126 and 97 given for the other candidates. Another Gas Manager—Mr. George Stevenson, of Long Eaton—was returned second on the list at the recent election of members of the District Council. Mr. Herbert Lees, the Manager, Engineer, and Secretary of the Hexham Gas Company, has been re-elected a member of the Urban District Council. Referring to the matter, a local paper remarks that Mr. Lees, having previously occupied a seat on the Council, will return to it with a fuller knowledge of the business to be transacted than one who is entering it for the first time.

LONDON AND SOUTHERN JUNIOR ASSOCIATION.

Visit to the Lea Bridge District Gas Company's Works.

A varied programme had been prepared for those members of the Association who journeyed to Leyton on Saturday afternoon. They assembled at the works of the Lea Bridge District Gas Company, at which their President (Mr. D. J. Winslow) is engaged, and over which they had the permission of the Engineer and Manager (Mr. F. W. Cross) to "roam at will." Tea followed the inspection, and then the party proceeded to the electricity works of the Walthamstow Urban District Council, facilities to inspect which were granted by the Engineer (Mr. G. R. Spurr). An examination of the show-rooms of both undertakings (which are situated in High Street, Walthamstow) brought the afternoon's proceedings to a close. On arrival at the gas-works, the visitors were met by Mr. Cross, Mr. Winslow, and Mr. D. C. Cross, who acted as guides during the subsequent tour of inspection.

This was not the first time that many of those present had had the privilege of inspecting the Lea Bridge Gas Company's works, for a visit was paid to them by the Association four years ago, during the presidency of Mr. W. J. Liberty—see "Journal" for Feb. 16, 1909, p. 453. These members were, however, amply repaid for joining the party on both occasions; for since the previous inspection various additions have been made to the works. Before noticing what was seen during last Saturday's tour, a moment may be spared to congratulate the Company on the excellent growth of their business. In the year 1905, the make of gas was 258 million cubic feet—a figure which by December, 1908, had risen to about 330 millions, and by the end of last year had mounted up to 430 millions. What will be the position of affairs at the close of a further period of four years? Perhaps if the members pay another visit in 1917, they will be told that the output is 500 million cubic feet, that the district is still in process of development, and that some more of the land which has been wisely provided for extensions has been brought into use for manufacturing or storage purposes. This extra measure of prosperity may be wished for the Company—as a minimum!

The Great Eastern Railway passes close to the works, into which coal is brought on a siding, and (by means of a hydraulic ram) tipped from the trucks into the elevator-pit. Bucket and belt conveyors then deposit the coal in the store, which is along one side of the retort-house, and has a capacity of about 1000 tons. From this point, it is raised as required, by a single-ram hydraulic lift to the charging hoppers above the retorts. The belt conveyor is so arranged that the coal can be tipped at any point desired in the store. These conveyors are, it may be mentioned, worked by gas-engines. The retort-house contains eight beds of inclined retorts, in settings of eight, and placed at an angle of 32°. They are of the usual Ω pattern, 24 in. by 15 in., and 20 feet long; the heating being by regenerator furnaces. The members were fortunate in being able to see one bench in course of reconstruction. Two beds were completely renewed last year, right down to the ground-level, and three more are now to be similarly treated. As the old arches and regenerators have done something like fifteen years' work, no fault is found with them on the score of length of life. It is noted that Gibbons's regenerators are being used, and that four out of the eight retorts being put in are tapered. On leaving the retorts, the coke is quenched and then wheeled out into the yard.

After passing a set of horizontal condensers, the exhauster-house is reached. The exhauster used for the winter make is an old Waller two-blade one; but it is to be converted this year into a four-blade machine. The one used in summer is of the same firm's latest four-blade pattern. Adjoining the exhauster-house, there are three small Cornish boilers, for driving the steam-pumps and engines, the booster turbines, and the washing apparatus. The boilers are fitted with forced draught arrangements, and only breeze is used under them. In fact, all the breeze made is consumed on the works. The gas passes through two small tower-scrubbers filled with wood, next through a 2 million cubic feet Livesey washer, and finally through a Clapham washer-scrubber—all traces of ammonia being thus effectually removed.

There are four water-lute purifiers; and (the Company being subject to the sulphur clauses) there is one tier of lime in each alternate box—the other boxes having a tier of "Lux." The remainder of the material used is, of course, ordinary oxide. The storage capacity of the three holders (1,100,000 cubic feet) is equal to about 61 per cent. of last winter's maximum day's make. The present make is 1,250,000 cubic feet per day, and the maximum output last year was 1,809,000 feet. The visitors were interested in the arrangement by which the gas is boosted from the holders to the inlet of the governors, in a manner which was described by Mr. Winslow in his Inaugural Address to the Association [see "Journal" for October 29 last, p. 367]. The plant, which was supplied by the Bryan Donkin Company, consists of two Rateau type fans, driven by 10-H.P. De Laval steam-turbines, each of a capacity of 200,000 cubic feet per hour; and by its aid the pressure of the gas is increased to 12 inches at the governor inlet. As was explained by the President, this apparatus was put down because it had become difficult to maintain a pressure of 5 inches on the outlet of the governors when the holders uncupped—this

pressure being necessary to enable a sufficient service to be given at points on the district farthest from the works. The whole of the gas passes through the boosting plant, which is installed between the exhauster and meter houses, in a small space which used to be a photometer-room. Since the members were last at the works, 24-inch and 12-inch Parkinson governors have been put down, and the old 16-inch governor has been brought up to date—all of them being now water-loaded.

The carburetted water-gas plant consists of three of Messrs. Humphreys and Glasgow's sets—two being of a nominal capacity of 550,000 cubic feet per day, and the other 1,000,000 feet. The last-named contains all the latest improvements, and has been erected since the time of the last visit. Bristol recording and indicating pyrometers are among the appliances adopted for the accurate working of the apparatus. The coke for the water-gas plant is raised by a hydraulic lift into three large hoppers above the roof of the house; and from these it is dropped through shoots into bogeys as required for charging. The new house, which is roomy and well lighted, consists of steel framing built in with brick. De Laval steam-turbines of 55 H.P. each are installed for driving two fans; and a stand-by fan is connected to a Marshall horizontal steam-engine. A Colman "cyclone" tar-extractor is used with this plant. The oil for the water gas is brought by rail to the works, and is pumped from the waggons into the storage tank. Separate plant is provided for the water gas, right up to the inlet to the holder where the mixture with the coal gas takes place. There are two gas-engine driven exhausters; and in the station-meter house is installed a Thorp rotary meter, of a capacity of 80,000 cubic feet per hour, which, after two years' experience, is pronounced to have given every satisfaction. Steam is raised in two 8 feet by 20 feet Lancashire boilers; while power for the coal and coke lifts is derived from two Arrol hydraulic engines, working up to a pressure of 700 lbs. per square inch. Housed with the latter are two air-compressors, employed for forcing into an overhead tank the water from the artesian well from which, since the advent of the Metropolitan Water Board, the Company have derived the whole of their supply. This well is 250 feet deep.

Another new feature of the works is the Wilton sulphate of ammonia plant, which was erected last year by the Chemical Engineering Company, and brought into operation in November. Its capacity is 3 to 4 tons of sulphate per day, and it is a complete unit, with its own boiler, &c. The plant is fitted with all modern improvements, and is installed in a substantial brick building. A point of interest is the roof. This is corrugated, and formed of a composition of which asbestos is the principal constituent. The wooden framework, too, is much lighter than would be required for slates. A further novel feature is the sight liquor feed. This is so arranged that it is possible to tell exactly how much liquor per hour is passing through the still. The acid supply is also conveniently placed on the other side of the stage, so that perfect control is secured. After remaining for about five minutes in the centrifugal dryer, the sulphate is dropped down a shoot into a barrow below, and is then weighed. There is storage room in the building for about 50 tons; and the sulphate in stock was noticed to be of an excellent colour. The floor on which it is placed is of concrete covered with pitch, with a wood covering; and the brick walls are pitched. The liming is carried out in a separate chamber; and the stage surrounding the sulphate plant is remarkably free from smell. The acid comes to the works by road, and is run into a boiler tank below ground, from which it is elevated by means of compressed air to the overhead storage tank. This tank and the liquor storage tank are placed on the reinforced concrete roof of the boiler-house. The gases from the sulphate plant are conveyed to a grating under a heaped oxide purifier, and they then gradually work their way to the top of the oxide.

These few notes of the works would not be complete were mention omitted of the first-class laboratory, which is replete with instruments that are, or should be, beloved by all those who are in charge of gas-works operations. Testing and recording appliances and two bar photometers are included in the equipment of this department. Lastly, there are the fitters' shop and the cooker repair shop, with overhead a commodious meter and fittings store, provided with a test meter and facilities for ascertaining the gas-consuming qualities, &c., of new lamps.

Mr. F. W. Cross, after tea, expressed his gratification at meeting the members of the Association at Lea Bridge. It was some four years since the Association had visited the works, during the presidency of Mr. Liberty. In the interval there had been many changes, and new works and extensions, as a result of increased business and greater output. It was by visiting works in this way that they could add to their store of information as juniors. He hoped the visit to the electricity works would prove of interest to them. It was a rare opportunity, and one which he trusted they would profit from.

The PRESIDENT said that, as an Association, they valued the good words of Mr. Cross. On again visiting Lea Bridge, they could see there had been great strides and many new works. It was gratifying to know that the make was increasing; that the Company had, under the excellent management of Mr. Cross, brought the price down to 3s. per 1000 cubic feet; and that developments still went on.

Mr. S. A. CARPENTER (Senior Vice-President) moved a hearty vote of thanks to Mr. Cross for giving his time to the Association that afternoon. It was appropriate that they should find themselves, at the end of a very full session, at the works with which their President was associated. They felt especially pleased with the large amount of detail Mr. Cross had shown them that afternoon. They often visited very large works in London, in which they seemed lost by their very magnitude; but in visiting a medium-sized works, there was much to learn from the compactness and orderliness observable. It was worth the whole time spent to see the working-up of the bye-products, which was education to some of the members; for there was the last word in a well-designed sulphate plant. He moved that the heartiest thanks of the Association be given to the Chairman of the Company (Mr. A. M. Paddon), and to Mr. Cross, for their kindness in granting facilities for the visit.

Mr. J. HEWETT (Junior Vice-President) seconded, and included in the vote the thanks of the Association to the staff under Mr. Cross, and to the Directors for their hospitality.

The vote having been carried,

Mr. CROSS thanked the Association, and said a chief could not carry out all the multifarious details of a gas-works unless he was served well; and he desired to pay a tribute to Mr. Winslow, who was responsible for the sale of the gas. It was no use making gas unless they had customers to take it; and it was Mr. Winslow's duty, as head of the Outdoor Department, to develop the sale, and thus increase the output. He felt that he was well served; and it was perhaps with a certain degree of parental pride that he was able to inform them that his son, Mr. D. C. Cross, the Principal Works Assistant, had just passed his examination for associate membership of the Institution of Civil Engineers. He appealed to them all as young men to do their work well, for without their aid the chiefs could not do as they did.

The party then adjourned to the Walthamstow electricity works, over which they were conducted by Mr. Spurr and Mr. H. Taylor, the Assistant-Engineer. Considerable time was spent in inspecting the latest Parsons steam-turbine, the water-softening plant, and the Babcock and Wilcox boilers.

Mr. J. G. CLARK, at the close of the inspection, proposed a vote of thanks to Mr. Spurr, assuring him that they greatly appreciated his kindness in being with them so long that afternoon—first at the gas-works, and then at the electricity works. Events showed that the future would hold great opportunities for gas and electrical engineers in working together for the utilization of Nature's resources.

Mr. W. J. LIBERTY, in seconding, remarked upon the large number who accepted Mr. Spurr's invitation to inspect the electricity works; and in case Mr. Spurr should be surprised, he thought that he might take upon himself the task of enlightening him. The members of the Association were out to learn things, and did not wish to grow up "one-sided;" for though in their ordinary vocations they were in friendly rivalry, they felt they had one object in common—to produce and supply, as cheaply as possible, for the common weal, light, heat, and power. In this great task they were working practically together. He thanked Mr. Spurr for giving up so much time in showing them all the details and ramifications of the works.

Mr. SPURR, responding, thanked the members for their kind words, which he greatly appreciated. During the seven years he had been at Walthamstow, he had received many kindnesses from Mr. Sandell, and particularly from Mr. Cross, with whom he was on the friendliest terms. It was true, as Mr. Liberty had remarked, there was "friendly rivalry" between them. He believed in competition, and thought it would be a sorry day when they were without it.

This brought the proceedings at the works to a close, and the members proceeded to visit the show-rooms of the respective concerns. At that of the Gas Company were to be seen plenty of novel and useful appliances—such as toasters, heating irons, washers, boiling-coppers, grilling-tables, and a good assortment of lighting fittings suitable for the locality. Mr. F. Gilbertson, in charge of the electricity show-room, showed the visitors the various appliances there; and at a very late hour the members journeyed back to town.

Oxy-Benzol Welding.

Writing on this subject in the Engineering Supplement to "The Times" of Wednesday last, an engineering correspondent said: "The employment of very high flame temperatures for welding and cutting metals has become so general, that some form of apparatus for this purpose has proved itself an indispensable auxiliary in the majority of engineering works of any magnitude. Up to the present, the combustible agents employed have been almost without exception oxygen and acetylene; but a new form of apparatus is now being brought into use in which the acetylene is replaced by benzol. On the Continent, a large number of experiments have been carried out with this new fuel, and the system has undergone thorough investigation and been subjected to severe comparative tests with the older process. As a result of these trials, it is now definitely settled that benzol may be employed with complete success, though no claim to superiority over the acetylene process can be made. In fact, there are certain disadvantages and drawbacks which for the present appear to be limiting the extent to which the apparatus is being adopted. Chief among these, perhaps, is the fact that with a liquid hydrocarbon such as benzol it is possible to obtain only a flame temperature of about 4750° Fahr., whereas the oxy-acetylene flame yields a temperature of at least 6750° Fahr. There are, moreover, certain risks to the operator which cannot be entirely ignored." The writer described the construction of the apparatus, and then compared the two systems which were the subject of his communication.

In noticing last week an advance of £50 per annum in the salary of Mr. Robert Watson, of Doncaster, it was stated that he would have a similar increase at the end of a year. We learn, however, that, though this was the recommendation of the Gas Committee, only the first-named increase was sanctioned by the Town Council.

THE REMOVAL OF SULPHURETTED HYDROGEN FROM GAS.

A patent has been taken out for France by Herr Karl Burkheiser for a process of eliminating sulphuretted hydrogen from gas. The following is a translation of the principal portions of the specification.

The patentee points out that the processes at present employed for the purification of coal gas to remove the sulphuretted hydrogen consist, almost without any exception, in bringing the gas, freed from tar and ammonia, into contact with lime or hydrated oxide of iron. Owing to the inertia of reaction of the materials in ordinary circumstances, this process involved very cumbersome plant. The Burkheiser process effected an improvement in this respect which gave the materials, by means of a preliminary treatment, great reactive power. All the usual systems, including the Burkheiser, were based upon dry purification, whereas the wet method was regarded as ideal; and many specialists and inventors had already endeavoured to find a practically applicable process. These endeavours were, however, not crowned with sufficient success to justify their employment.

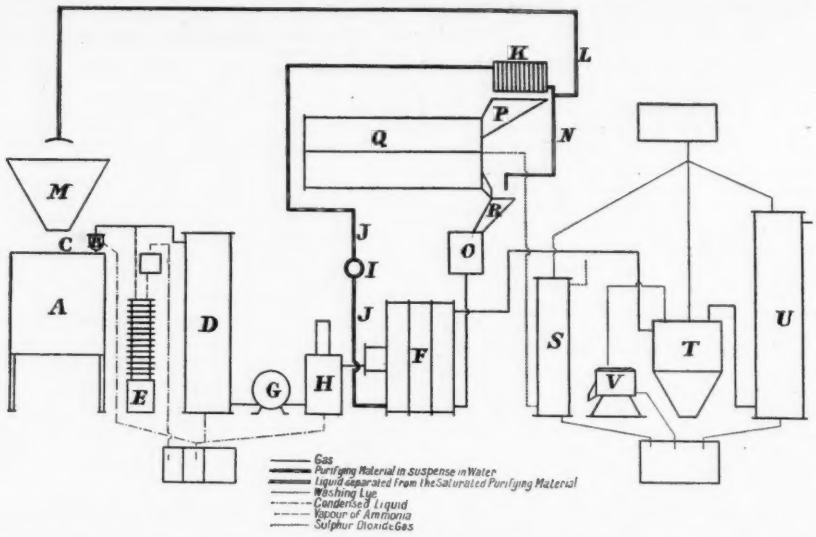
The process which appears to be the suitable one for wet purification is washing the gases with a solution of metallic salts. The experiments made in this direction should not give satisfactory results, as regeneration of these solutions is very difficult, not to say impossible. Endeavours have also been made to purify gas with a kind of emulsion of hydrated oxide of iron or limonite in water. This process could not be employed because the hydrated iron oxide reacted too slowly in the absence of a sufficient amount of alkali.

The present invention is a process to separate the sulphuretted hydrogen from the gas by utilizing the great reactive power of the alkalies, and also to regenerate the alkaline sulphides by treatment with hydrated oxide of iron. With this combination, it will be possible to increase the reactive power between the sulphuretted hydrogen and the oxide in the wet process, so as to reduce to a minimum the area required for the purifying plant.

The practical application of the process is as follows: The gas is treated in a washer with an alkaline solution, and then the sulphur is removed from the sulphuretted alkaline materials by means of an emulsion of hydrated oxide of iron, so that the alkaline solution can be again employed to free gas from sulphuretted hydrogen. A particular feature of the process, which is especially recommendable when it is a question of coal gas containing a large amount of carbon dioxide, consists in conveying together to the washer the iron oxide and the alkali solution, so that the latter will be immediately regenerated, and again made suitable for removing the sulphuretted hydrogen. The saturated sulphate of iron combinations are separated from the alkali solution by filtration, decantation, &c.; and the filtered solution is again utilized for washing with fresh oxide of iron.

The invention also comprises the employment of the ammonia contained in the gas instead of a special alkali. The sulphuretted hydrogen is separated immediately after the tar—that is to say, elimination of sulphuretted hydrogen is effected when the gas still contains its ammonia. Consequently, the employment of a special alkali becomes useless, because, as already stated, the ammonia in the gas acts instead. With this method there is the special advantage that all the inconveniences due to sulphuretted hydrogen disappear on the regeneration of the ammonia, and that then the ammonia can be directly regenerated as such, or as sulphite or sulphate, from the gas, in the purest form.

Another application of the process consists in oxidizing the sulphur in the purifying materials separated by filtration from the alkaline solution, either singly or with the mass, to form sulphur



dioxide or trioxide, to be employed for the combination of ammonia contained in the gas; while the mass, freed from sulphur and again active, is once more employed to regenerate the absorbing liquid.

By the process for the purification of gas from sulphuretted hydrogen just described, the cyanides in the gas (if the requisite steps are not taken) require a large proportion of oxide of iron for the formation of the insoluble ferrocyanic compounds; and this renders difficult the complete regeneration and further use of the purifying materials. The invention, therefore, has also for its object the prevention of the formation of insoluble ferrocyanic compounds by adding a little sulphur or sulphurous material to the alkaline solution, or a little air or oxygen to the gas. Thus all the cyanides will be completely absorbed at the same time, because the alkaline polysulphides can be formed, and all the cyanide will be transformed, in corresponding alkaline sulphocyanic conditions. These combinations can easily be separated from the iron sulphide compounds, because they are very soluble, and will then be treated separately.

The following is a method which has been put to practical tests. The gas produced in the retort A passes through the hydraulic main B and the pipe C into the condenser D, where it is cooled. The ammoniacal liquor collected in the condenser is treated in the distilling column E, and sent back into the gas before it reaches the purifier F. The exhauster G draws the gas, and pumps it through the tar-extractor H, where the final traces of tar are removed. The gas then enters the purifier, which is a rotary one, of the cyanide scrubber type. The washing liquor, which contains the hydrated oxide of iron in suspension, is pumped from compartment to compartment to meet the gas, so that in the last compartment—viz., that into which the gas containing the sulphuretted hydrogen enters—the mass is almost saturated with this impurity, and the washing liquor is richest in sulphocyanic compounds. From this last compartment, the saturated mass is drawn by the pump I through the pipe J into the filter-press K, where the liquid is separated from the mass. Part of the liquid is pumped through the pipe L, towards the coal-hopper M, where it will slightly damp the coal, and then be conveyed with it into the retort, where the sulphocyanic compounds are transformed into ammonia, which then re-enters the gas. The remainder of the liquid from the filter-press and the water employed to wash the filtrate run through pipes N into the tank O, furnished with an agitator. The remainder of the liquid passes through the passage P into the regenerator Q, where the mass is revivified with air until sulphur dioxide or trioxide is formed. The revivified materials flow out of the regenerator through the passage R, fall into the tank O, to be pumped with the washing liquor from the filtration into the rotary purifier F, there to resume their cycle. The sulphur dioxide formed in the regenerator is washed in the air-scrubber S, and the ammonia in the gas in the saturator T and the ammonia scrubber U. The precipitated salt is removed from the lye in the hydro-extractor V.

FORMATION OF COAL AND THE MANUFACTURE OF HYDROGEN.

A paper on "High-Pressure Reactions: The Formation of Coal and of Hydrogen" was read by Dr. F. Bergius, of Hanover, at the meeting of the London Section of the Society of Chemical Industry, which was held at Burlington House on Monday, the 7th inst., under the chairmanship of Professor W. R. Hodgkinson. Some particulars of the researches of Dr. Bergius on the artificial formation of coal were given in the "JOURNAL" of Aug. 27 last

[Vol. CXIX., p. 571]; and it is therefore now only necessary to refer briefly to points not already dealt with.

According to Dr. Bergius, the application of physical-chemical laws to problems of pure and technical chemistry has of late years become of constantly increasing importance. It is possible to calculate exactly the quantitative relations between chemical reactions and their dependence on the external conditions of temperature, pressure, and a supply of energy. Until recently, however, comparatively little has been done in regard to the influence of a considerable increase of pressure of the components on the course of a reaction. But it has been evident from the researches of Haber and Le Rossignol, which had resulted in the elaboration of a process for the direct synthesis of ammonia from its elements under high pressure, that an extension of chemical investigations to systems under high pressure would be likely to be very prolific of good results. The Baden Aniline and Soda Works have erected an installation for the working of this process, which is so large that it will be able to supply a very considerable proportion of the German consumption of ammonia. Dr. Bergius has been engaged for some years past in working out a convenient method for investigating reactions of widely different kinds under high pressures. The pressures used have greatly exceeded those of the ordinary modern autoclave or bomb. With various collaborators he has thus investigated a number of reactions to which high pressures are favourable. The effect of pressure may be different in different cases. Thus the equilibrium of a reaction involving molecular change is shifted by compression of the gaseous components in the direction which gives the product that involves the greatest diminution of volume. The synthesis of ammonia from nitrogen and hydrogen under pressure is of this character, as two volumes of nitrogen and six volumes of hydrogen unite under pressure to form four volumes of ammonia. Passing on to less simple systems, Dr. Bergius has succeeded in converting lime into calcium peroxide by the use of oxygen at high pressures.

In the case of reactions in which a liquid component is concerned, and in which the reaction proceeds only slowly at the boiling-point of this component, higher pressures admit of the liquid being heated to temperatures above its boiling point; and at these temperatures the reaction proceeds more quickly. In this way, Dr. Bergius had succeeded in burning carbon by means of liquid water into hydrogen and carbonic acid, at temperatures of about 350° C. The physical properties of liquids may be changed by their being heated above their boiling-point, and favourable conditions for reactions may thus be attained. In this way hydroxyl compounds of aromatic hydrocarbons, such as phenol, have been produced from the chlorine compounds and aqueous solutions of alkali. This has been effected by working at temperatures at which the water has a vapour pressure of about 100 atmospheres. In other cases, superheated water may be of service merely in providing a reservoir of heat; and it is in this way that superheated water has come into play in the formation of coal.

The apparatus used by Dr. Bergius in his experiments on reactions at high pressures was based on that used by Haber and Le Rossignol in their synthesis of ammonia. Packing of fibre or soft metal was entirely dispensed with, and all joints were made with cones, metal on metal. After numerous trials, apparatus was thus constructed which would hold for several weeks pressures of more than 150 atmospheres at temperatures of 300° to 400° C., with only an inappreciable loss of pressure. Such a high degree of soundness was essential for investigations such as those on the formation of calcium peroxide, the dissociation pressure of which at about 170° C. exceeds 100 atmospheres. In these investigations measurements of pressure were made over a period of three weeks. The water-gas reaction between carbon and water only begins to take place at a reasonable velocity at temperatures exceeding 600° C., when the water is in a state of vapour. But with liquid water, the reaction occurs at considerably lower temperatures if a catalyst—such as a thallium compound—is dissolved in the water.

Dr. Bergius proceeded, in his paper, to describe the experiments already referred to in the "JOURNAL" (*loc. cit.*) on the formation of coal by chemical processes in the laboratory. The decomposition of cellulose, wood, and peat is of an exothermic nature, as the following formula shows, and the phenomena of wood distillation demonstrate.

(Cellulose.) (Coal Substance.)

$$4C_6H_{10}O_5 = C_{21}H_{16}O_2 + 3CO_2 + 12H_2O \ (+ \text{ 70,000 gramme-calories}).$$

The heat resulting from the dissociation of cellulose, &c., if not abstracted, causes the cellulose to attain a temperature greater than that of the containing vessel, and the process of the formation of coal is changed into a coking process. Coals produced from cellulose or wood in this way always contain less hydrogen than natural coal. This is shown from the appended table, which gives the proportions of carbon and hydrogen in natural bituminous coal, and the proportions in the artificial coals produced by Stein and Klason, as well as of that produced by Dr. Bergius in collaboration with Specht. The artificial coal of Bergius and Specht, of which samples were exhibited at the meeting, contains a higher proportion of hydrogen than the artificial coals of Stein and Klason, and is in this respect comparable with natural coal.

	Carbon. Per Cent.		Hydrogen. Per Cent.
Natural bituminous coal	75 to 90	..	4·5 to 5·0
Artificial coal, Bergius and Specht .	74·3 to 85·2	..	4·5 to 5·2
,, ,, Stein	81·3	..	3·8
,, ,, Klason.	82·5	..	4·1

The samples exhibited had been produced by taking advantage of the good heat conductivity and high specific heat of liquid water to prevent any local superheating of the decomposing particles. The formation of coal does not take place at an appreciable rate until the temperature exceeds 300° C. Hence it was necessary to work with high pressures, because water at this temperature has a vapour pressure exceeding 100 atmospheres. As a raw material, first cellulose and then peat containing about 85 per cent. of water were used. It was heated in high-pressure bombs, and the resultant gases were withdrawn and analyzed. They consisted chiefly of carbonic acid.

The artificial coal varies in composition according to the temperature and length of time employed in its formation. This is clearly shown by the table in the "JOURNAL" for Aug. 27 last, which Dr. Bergius gave again at Burlington House. He also referred to the estimate of the time which has been required in Nature to produce coal, based on the ratio of temperature to time in the experiments on the formation of artificial coal. This estimate (of about 8 million years) agreed fairly well with the 7 million years which some geologists had named.

The greater part of the paper, so far as it referred to the formation of coal, has already been published in German technical journals. Dr. Bergius, however, also described a process for the manufacture of hydrogen by the reaction of iron with liquid water at high pressures according to the equation:

$$3Fe + 4H_2O \rightleftarrows Fe_3O_4 + 4H_2.$$

The rate of formation of hydrogen by this method was influenced by the electrolyte and by temperature. Thus with pure water at 305° C. 0·13 litre of hydrogen was produced per hour; whereas with water containing ferrous chloride 0·77 litre, and with water containing ferrous chloride and copper 1·20 litres, of hydrogen were produced per hour at the same temperature. On the other hand, corresponding with a production of 0·77 litre of hydrogen per hour at 305° C., there was obtained 1·16 litres per hour at 340° C., and 1·54 litres per hour at 355° C. The hydrogen produced by the process contained 99·6 per cent. of hydrogen and a trace (0·006 per cent.) of carbonic oxide. In practice, 1 kilo. of iron was oxidized in about six hours, yielding 600 litres of hydrogen. This is equivalent to 1 lb. of iron generating 9·6 cubic feet of hydrogen. The reacting bomb had to be made with special steel, or lined, in order to prevent the steel entering into the reaction at the high pressure used. An advantage of the process, which makes for economy when the gas is required for charging cylinders or for use at high pressure, is that it is at a still higher pressure in the producing apparatus, and can be directly drawn off into cylinders, &c. The process is already in course of adoption in Germany on a very large scale. The cost of hydrogen, manufactured in fairly large plant, by this process is 5 pfennig per cubic metre (1s. 5d. per 1000 cubic feet).

Dr. Bergius read his paper in English, and was congratulated by Professor H. E. Armstrong, F.R.S., who opened the discussion, on his command of the English language, and on the highly entertaining matter which he had presented. Professor Armstrong pointed out that there were many different varieties of coal, and that the author had still a lot of investigation to make to account for the differences in natural coals, &c.

Mr. Charles Carpenter added his congratulations to the author on the paper he had presented. The apparatus with which the investigations had been made, and the plant by which the manufacture of hydrogen was being carried out, had interested him very much from the standpoint of mechanical engineering.

Among others who joined in the discussion were Dr. Harold G. Colman, Mr. W. J. A. Butterfield, Mr. A. C. Chapman, and the Chairman.

Dr. Bergius, in the course of a long reply, referred to many points, some of which have already, for convenience of reading, been incorporated in the foregoing report of his researches and processes.

Institution of Water Engineers.

We learn from the Secretary of the Institution (Mr. Percy Griffith, M.Inst.C.E.) that the following candidates for membership have been elected by the Council:

Members.—Mr. Basil Mackenzie, of Stockport; Mr. Gomer Sweeting Morgan, of Pontypridd; Mr. John Parker, of Hereford; Mr. Hugh Percival Raikes, of Birmingham; and Mr. Joseph E. Willcox, of Birmingham.

Associate Members.—Mr. Arthur Gregory Beaumont, of Leeds; Mr. Walter Felthouse Bickford, of Camborne; Mr. Brij Mohan Lal, of Cardiff; Mr. Edgar Couch Lemon, of Wakefield; Mr. Thomas Shand, of Stockport; and Mr. Reginald Victor Toms, of Torquay.

Associates.—Mr. Robert Scott Hankinson, of Southampton; Mr. William Paterson; Mr. Luisdell Richardson, Inspector of Technical Education, Gloucestershire.

The following have been transferred from the class of Associate Member to that of Member: Mr. H. W. Bland Cotterill and Mr. Neil James Peters, both of Cardiff.

CORRESPONDENCE.

[We are not responsible for opinions expressed by Correspondents.]

Competent Engineering and Design.

SIR,—It is very kind of "Civil Engineer" to interest himself in our welfare, and to point out the way of salvation; but speaking as a gas-works contractors' engineer of thirty years' experience, I venture to assert that his statements are entirely erroneous, and that in no branch of engineering is theory more carefully regarded or better understood. There is no reproach in allowing practice to qualify theory to a reasonable extent; and qualification of this kind is probably less in gas-works structures than in the shipbuilding designs to which your correspondent refers.

April 12, 1913. EXPERTO CREDE.

Alliance and Dublin Consumers' Gas Company.

SIR,—I went to some little trouble to prepare the notes on which my letter of the 26th ult. was based; and although subsequently hastily dictated, it nevertheless contained accurate and pertinent points which I consider were entitled to some consideration from the Chairman, to whom I believe you kindly sent a copy before the shareholders' meeting.

The letter was not as comprehensive as I should have made it for publication only, had I known it would have been treated with scant courtesy by the Directors, and no attempt to answer even one of the several points raised.

It is, therefore, necessary that I should recapitulate the points, in order that those who are interested in the controversy may appreciate fully the purport of the matters referred to.

1. *Capital.*—I pointed out that there was a debit balance on the 31st of December of nearly £50,000 (and ere this it would possibly be £60,000), and that this sum raised by ordinary stock at or about the present market price (approximately 75 per cent.) would represent an additional annual dividend of £3900, or £1950 for the half year. For the past half year, interest and dividend absorb £44,296 16s. 4d. Undoubtedly, the Company must come into the market for additional capital at an early date; and this is emphasized, having regard to the overdraft of £40,000 at the bank on the 31st of December.

2. *Debentures.*—Incidentally, I mentioned that the debentures issued represent £374,000, at 4 per cent., equal to £7480 interest half yearly; whereas the accounts only show £7043 13s. 6d.

3. *Dividend against Profits.*—The amount of profits earned for the half year was insufficient by £2000 to meet the interest and dividends. Such being the case, I invited the Directors to explain to the shareholders how they proposed to meet the additional dividends required on the new capital, especially having regard to the *increasing* price of coal.

4. *Extra Works Repairs.*—There is £2608 increase on this account, for which an explanation was invited—particularly after the fact that special items (with this Company) are generally placed to a suspense account.

5. *Gas Revenue.*—For the half year ended the 31st of December, 1911, there is shown in the accounts a sale of 747,708,350 cubic feet to private consumers, yielding a revenue of £87,618 16s. 10d. For the past half year (corresponding with the one just referred to) the revenue is £3148 17s. 3d. less, although an increased quantity of gas has been so sold to the extent of 8,621,000 cubic feet. Furthermore, the figure of 747,708,350 cubic feet was queried; and it was suggested that this represented the total quantity of gas accounted for in the December half year of 1911.

6. *Suspense.*—It was suggested that, instead of extending the wiping-off of the account for modernizing the retort-houses until 1918, or beyond, the credit balances of £12,370 14s. 8d. and £4147 16s. 3d. be utilized, and so shorten the period of suspense.

7. *Carry Forward.*—It was submitted that, after paying the dividend, there was but £1226 11s. 1d. forward; and for a company of the size of the Alliance and Dublin this is by no means sufficient to carry forward, and shows an unsatisfactory state of affairs.

8. *Notice of Meeting.*—It was pointed out that the British stockholders, instead of receiving fourteen clear days' notice, had six days, as the only notice in England (that I know of) accompanied the accounts, which are generally posted in Dublin on Saturdays, and therefore not received here until Monday mornings.

General.—I submit these points as clearly as possible for consideration, although it is not unlikely that the Directors, with their attitude, will continue to ignore genuine criticism and comfort themselves in the knowledge that their undertaking is one which stands isolated in all British gas undertakings for its unique results. This is evidenced by the Chairman's remarks that the Gaslight and Coke Company were over £40,000 short of dividend, and the South Metropolitan over £30,000 on the half-year's earnings. It was ignored that the Gaslight and Coke Company dropped 1d. per 1000 cubic feet (reduction to 2s. 6d.) over the period, representing more than the deficit; and the South Metropolitan Company are selling gas at 2s. 2d., against the Dublin 3s. 4d. per 1000 cubic feet.

It is a case of "Wake up, Dublin!" or pity help the shareholders.

April 11, 1913. NONULUS.

The recent elections for the Heaton Norris Urban District Council were fought on the question of amalgamation, in which Manchester and Stockport have lately been interested. Four members were to be elected; and the result was that two councillors who were in favour of amalgamation (with either Manchester or Stockport) were defeated, and only one was re-elected. Sir T. T. Shand, the Chairman of the Council, and a member since its formation, who was a supporter of amalgamation with Manchester, was beaten by a majority of 148.

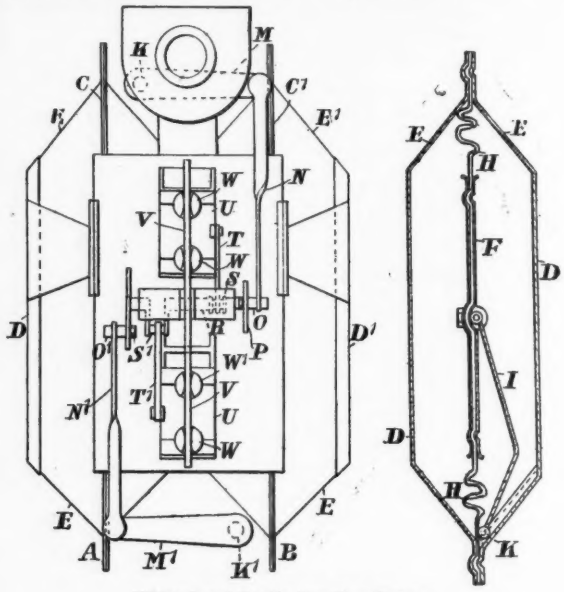
REGISTER OF PATENTS.

Gas-Meters.

HIBBERD, C. E., of Tooting Bec, S.W., and GOAD, F. L., of Edinburgh.

No. 6463; March 15, 1912.

The object of this invention is "to minimize the defects in existing meters," and, in particular, "to provide an improved gas-meter which shall give substantially correct indications over comparatively large ranges of pressure and consumption," by the combination in the meter of measuring chambers, each containing a diaphragm oscillating about its central position of support within extreme positions, defined (or approximately defined) by the walls of the chambers, and valves controlling the flow of gas to and from the measuring chambers, and driven from a crank-shaft operated from the diaphragms—the crank-pin being adjusted or adjustable circumferentially so as to cause the valves to close in advance of the dead-points and open immediately on the return motion of their respective driving elements.



Hibberd and Goad's Dry Gas-Meters.

The illustrations are a plan of one form of the meter, and a horizontal cross-section showing the general characteristics of a measuring chamber of the type to which the invention applies.

Two measuring chambers A B are arranged back to back, each chamber being formed of front and back walls connected by a centre point C C¹. [The two chambers A B being similar, one only will be described; corresponding parts of the other chamber being denoted by the same reference letter accented.]

Taking the left-hand chamber by way of example, it will be seen that the chamber is substantially rectangular in form with flat centre portions D and inclined peripheral portions E running down to the joint C. The diaphragm consists of a vane F, of rectangular shape corresponding to the part D of the chamber, and a surrounding membrane H, which is centrally hung (say) by clamping between the parts of the chamber. The vane itself is fitted with the usual flag I and flag-rod K, disposed vertically; the upper end of the flag-rod being provided with a transversely disposed arm M, connected by a link N to a crank-pin O, attached to a crank P on a crank-shaft R, disposed transversely. The crank-pins at each end of the crank-shaft are adjustable circumferentially along a circular groove Q in the crank concentric with the axis of the crank-shaft; while, in addition, the crank-shaft is provided with a pair of cranks S S¹, disposed at a suitable angle and connected respectively by connecting rods T T¹ to the valves U U¹, which may be arranged to reciprocate in line with one another. A guide-rod V co-operates with horns W W¹ on the valves to maintain their alignment.

By means of the circumferential adjustment provided, the relation of the valves to the reciprocating diaphragms may be adjusted; and, in particular, "the valves may be so set as to close in advance of the dead-points of the vanes at both ends of their stroke—thus causing the meter to run true at different pressures."

Distillation of Shale and Other Bituminous Substances.

NOAD, J., of East Ham, Essex.

No. 21,441; Sept. 20, 1912.

This invention has for its object "to obtain a more uniform and complete heating and desulphurizing of the shale or other bituminous substance than is attained in the customary processes, and to prevent the mass under treatment from becoming clotted together."

The shale is first broken up; water is next added and mixed with the shale granules; and slacked lime is then added and mixed with the liquid-coated shale granules so as to be caused to adhere to, and form a completely enveloping coating around, the shale granules, and through which coating of lime the products of distillation must pass. Lastly, the lime-coated shale granules are gradually fed into a retort,

presenting a series of step-like ledges, and gradually worked down from ledge to ledge; the volatile constituents escaping through the lime coating, and being led away from the upper part of the retort to condensing apparatus, and the sulphur being arrested by the lime coating and, together with the exhausted shale, being discharged from the lower part of the retort.

The crushing of the shale, says the patentee, ensures an intimate and even reaction of the slacked lime on the shale, and the coating of the shale granules with liquid before the addition of the lime enables a small quantity of the water to suffice to cause adhesion of an even lime coating around the shale granules. A convenient size for the shale granules is obtained by passing them through a mesh of 8 to 3 to the inch.

The proportional quantity of slacked lime to be used to obtain the most satisfactory results, of course, depends upon the particular shale under treatment and "is determinable in practice." By way of a practical example, the patentee cites a Kimmeridge shale containing 3 to 4 per cent. of sulphur. Here satisfactory results may be obtained by employing about 1 to 2 parts of slacked lime to 16 parts of crushed shale, by weight. About 1 oz. of water to 1 lb. of crushed shale is said to give satisfactory results.

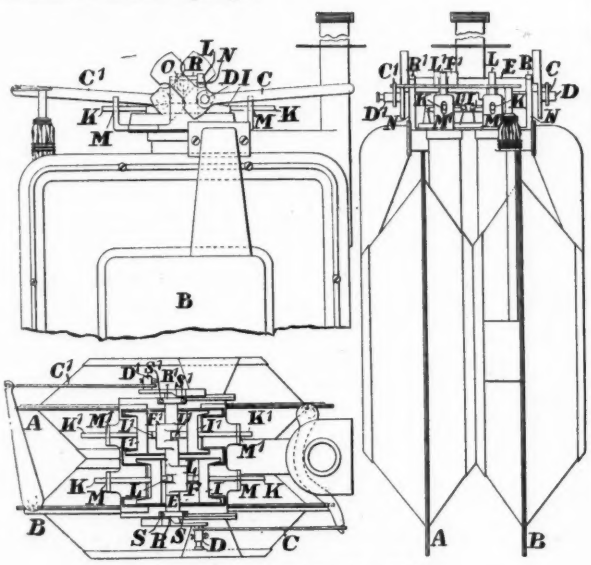
The preferred construction of retort for use in carrying out the invention was described and illustrated in the "JOURNAL" for Dec. 27, 1910 (p. 935), when summarizing patent No. 18,334 of 1909.

Gas-Meters.

HIBBERD, C. E., of Tooting Bec, S.W., and GOAD, F. L., of Edinburgh.

No. 6464; March 15, 1912.

This invention relates to dry gas-meters of the type having a plurality of measuring chambers each controlled by its own reciprocating valve driven from a diaphragm.



Hibberd and Goad's Dry Gas-Meters.

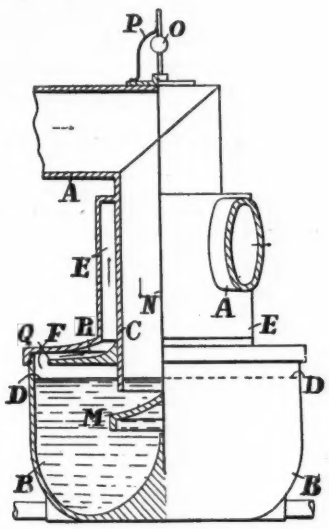
In the form shown, two measuring chambers A and B are arranged (as usual) back to back. [The two chambers being similar, only one will be described in detail; corresponding parts of the other being denoted by the same letters accented.] Taking the left-hand chamber A by way of example, it is provided with the usual diaphragm, and flag (not shown) and flag rod; the latter being arranged vertically. At its upper end it has rigidly attached to it an arm or lever extending in a transverse direction and coupled by a link C to a crank-pin D, mounted on the end of a shaft or spindle E, arranged across the two measuring chambers on the top. The position of each crank-pin is fixed or adjustable circumferentially in relation to its corresponding crank, to enable small errors in the rate of registration of the meter to be corrected. The spindle itself is provided with two cranks F F^1, set preferably at right angles and passing between horns or projections L L^1 on the valves I I^1 themselves. They are arranged below the spindle, and are reciprocated side by side lengthwise of their respective measuring chambers. The valves may work in conjunction with a movable grid, and be prevented from rising by rods K K^1 at each working through eyes M M^1. The valves themselves are preferably of the D-type, and are provided with a moderate amount of both outside and inside lap. The transverse spindle carrying the eccentrics is mounted in brackets N N^1—one at each end. Each bracket has a slot or recess O at the top, in which the spindle rests; a cap R secured by screws S, being provided to hold the spindle in place. The cams, cranks, or eccentrics are preferably arranged at right angles on the spindle; and one valve may, therefore, be closed to gas while the other is open.

Preventing the Backward Propagation of Flame in a Conduit Conveying Combustible Gaseous Mixture.

IONIDES, A. C., of Porchester Terrace, W.

No. 14,717; June 24, 1912.

This invention relates to devices for preventing the backward propagation of flame in a conduit conveying a mixture of a combustible gas and a supporter of combustion to a point where ignition is effected; its object being "to provide a simple and yet reliable device which is specially suitable where large volumes of fluid have to be dealt with, as in conduits of one inch or over in diameter."



Ionides' Back-Firing Preventer.

According to the method of carrying the invention into effect, as illustrated, there is provided in the conduit A, between the source of the combustible gaseous mixture and the place where ignition takes place, a chamber B, containing (say) castor oil, the surface area of which is considerably greater than the cross sectional area of the conduit A. The incoming part C of the conduit projects below the level D of the liquid in B, while the outgoing part E communicates with the space F above the liquid—the conduit part E being concentric with the incoming part C for some distance along the latter. A non-return valve M, which utilizes as a seating the end of the immersed conduit part C, is mounted upon a guided spindle N passing axially through the conduit part C, and preferably carrying at its upper end automatic means (such as an enlargement O) which, by engaging with a spring P, holds the valve M on its seating when it attains its top position.

The valve M is preferably of circular cross section, which increases in area towards the end immersed in the liquid, and has such an external surface as to provide between the valve and its seating a passage of as nearly as possible constant cross-sectional area when the valve is fully open. In order that the large surface area of the liquid in the chamber B may be utilized to the best advantage, deflecting means (such as a plate Q), attached to the conduit part C, may be provided to direct the backwardly propagated flame towards the periphery of the liquid surface. Such a plate, when provided, should if possible be arranged to maintain a passage R of substantially constant cross-sectional area for the flow of mixture in either direction. When the device thus modified is in operation, the non-return valve M remains open, and the pressure of the incoming mixture depresses the liquid, within the immersed conduit part C, until the mixture passes freely into the space F above the liquid, and thence to the other conduit part E, as indicated by the arrows.

On the occurrence of a back-fire the liquid is displaced into the immersed conduit part C; but at the same time the pressure exerted on the valve M closes the latter, which remains closed on account of the spring P now engaging the enlargement O on the valve spindle N. The conduit is thus completely closed by a valve M which is sealed on both sides by liquid. Consequently, the backward propagation of flame along the conduit is prevented; and until the valve M is opened by hand, there is no flow of mixture along the conduit, and no leakage past the valve, "even though grit may settle between the same and its seating."

Gas Producer Systems.

MARKS, E. C. R.; a communication from the Standard Gas Power Company, of Atlanta, Georgia, U.S.A.

No. 22,722; Oct. 5, 1912.

The principal object of this invention is "to provide a generator having a novel combination of parts, such combination being calculated to materially increase the efficiency of the generator."

It has been previously proposed, the patentees state, to provide a generator with a superimposed vaporizer, the vapour from which was adapted to be admitted into the fire zone at a plurality of points; while the gas produced was led off through a number of small flues formed in the vaporizer. Also it has been proposed, in a generator having a bottom central off-take, to introduce heated air through a depending pipe into the centre of the generator—the air also being capable of passing into the fire zone at a plurality of points.

The present invention comprises, as an important feature, the combination of a gas generator, having a central gas off-take, with a vaporizer, and means for conveying the air and vapour from the vaporizer into the fire zone at a plurality of points, whereby the draught is disseminated through the incandescent fuel and toward the gas off-take.

A subsidiary feature consists in providing an additional vaporizer, the vapour space of which is adapted to be placed into or out of communication with the vapour space of the other vaporizer; while an intake is provided leading from the additional vaporizer to the interior of the generator for the purpose of conveying air and vapour thereto.

A still further subsidiary feature is the provision of an independent side gas off-take in addition to the central off-take.

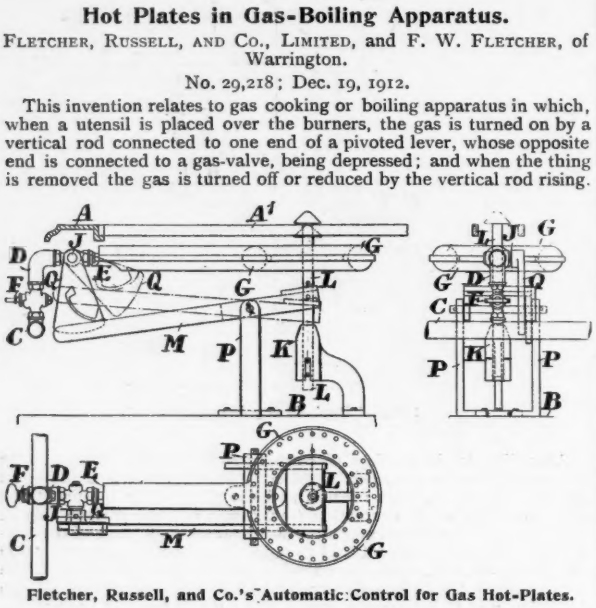
No claim is made broadly to the use of a vaporizer in connection with a gas generator. It has, for example, been suggested to provide adjacent to the bottom of a generator a coil or coils of pipe, the ends of which were carried upwards—one into the vapour space and the other into the water space of a small boiler placed at the top of the generator. No provision was made, however, to convey any vapour which might be formed in the coil or coils directly into the interior of the generator, as is possible according to the present invention.

Hot Plates in Gas-Boiling Apparatus.

FLETCHER, RUSSELL, AND CO., LIMITED, and F. W. FLETCHER, of Warrington.

No. 29,218; Dec. 19, 1912.

This invention relates to gas cooking or boiling apparatus in which, when a utensil is placed over the burners, the gas is turned on by a vertical rod connected to one end of a pivoted lever, whose opposite end is connected to a gas-valve, being depressed; and when the thing is removed the gas is turned off or reduced by the vertical rod rising.



Fletcher, Russell, and Co.'s Automatic Control for Gas Hot-Plates.

Mounted on brackets secured to a plate B is an ordinary hot plate A, to which is fitted a gas-pipe C, along the front of, and a little below, it. Connections D are made at convenient distances apart with bunsen burners E connected to burners G. Each connection is fitted with an ordinary stop tap F for turning the gas supply to the burner on or off, and a tap J for automatically regulating the supply when a pan is placed over the burner and when removed therefrom. This is effected by placing, in a socket K secured to the table, a spindle L to slide vertically in the socket, but limited in the extent that it may be caused to be raised by a pin sliding in a slot in the socket, and the extent that it may be pressed down by a pin above the end of the lever M, which is pivoted to a bracket P secured to the table. A curved projection on the face of a quadrant Q connects the apex of the quadrant to the spindle of the tap J in such a position that, when the end of the curved projection is resting on, and pressing down, the end of the lever M, the gas is turned off from the burner, and the upper end of the spindle L is a little above the level of the hot plate. When, however, a pan is placed over the burner, the spindle L is pressed down until the top is level with the hot plate, which will cause the end of the lever M to rise, and the curved projection on the quadrant Q to slide along the lever M, thereby opening the tap J and allowing the gas to pass to the burner. When the pan is removed from over the burner, the quadrant Q will revert to its original position and shut off the gas, either partly or entirely as may be arranged.

APPLICATIONS FOR LETTERS PATENT.

APPLICATION FOR RESTORATION OF LAPSED PATENT.

Notice is given that HERMANN BLAU has made application for the restoration of the patent granted to him, for "Improvements relating to the liquefaction of illuminating gas by pressure," No. 2292 of 1909, and bearing date Jan. 31.

7598.—ALLEN, P. R., "Cooling elastic fluids." March 31.
7601.—KOPPERS, H., "Distilling fuel." March 31.
7643.—EATON, E., "Artificial briquette fuel." April 1.
7664.—LARDEAUX, A. H., "Utilizing exhaust gases." April 1.
7677.—POTTERTON, T., "Hot-water apparatus." April 1.
7685.—HIGGINS, W., and STEVENS, W. S., "Storage of gas." April 1.
7708.—BRITISH GRAETZIN LIGHT, LIMITED, and MEADS, H. J., "Automatic cut-off valves for gas-lamps." April 1.
7829.—THOMPSON, H. S., and SUTTON, C. J., "Mantles." April 3.
7851.—JACKSON, T., and RAMSAY, A., "Gas-meters." April 3.
7853.—GARSIDE, E., "Prepayment gas apparatus." April 3.
7880.—AIREY, G. H., "Gas-burners." April 3.
7887.—TEJERO, L., and BOIVIE, E. A., "Production of regenerated gas." April 3.
7888.—CALTHROP, E. R., and LYNDE, F. G., "Construction of reservoirs." April 3.
7960.—HUME, G. W., "Gas-controllers." April 4.
7979.—SCHEIDEGGER, A., "Attaching mantles." April 4.
8006.—DANIELS, L. W., "Gas-regulators." April 5.
8029.—SUGG, W., AND CO., LIMITED, and MATTOCK, W. G. H., "Mantle-rings." April 5.
8037.—REYNOLDS, A., "Regenerative furnaces." April 5.
8042.—BINZ, G. A. H., "Determining by weight quantities of gas, &c." A communication from Carl A. Hartung. April 5.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF COMMONS.

The following further progress has been made with Bills:—

Bill reported: Swanage Urban District Water Bill.

Bill read the third time and passed: Coventry Corporation Bill.

The Bishop's Waltham Water Bill has been referred to the Select Committee presided over by Sir Harry Samuel.

The petitions against the following Bills have been withdrawn:

Heathfield and District Water Bill, by the East Sussex County Council.

THE EDINBURGH GASLIGHT EXTINGUISHERS AND NATIONAL INSURANCE.

On Monday last week, Mr. LYELL asked the Secretary to the Treasury whether his attention has been called to the case of a number of men employed by the Edinburgh and Leith Gas Commissioners in putting out the gas lights on common stairs every morning at the rate of 1s. 5d. each morning, or less than 10s. a week; whether he was aware that these men were compulsorily insured from July 15, 1912, until Feb. 8, 1913, when they were informed that they were outside the compulsory provisions of the National Insurance Act, but had the option of continuing as voluntary contributors; and whether, in view of the fact that these men had 33 weeks' deductions made from their wages under a misapprehension, he could see his way to refund to such of them as did not insure as voluntary contributors the deductions, amounting to 11s. apiece.

Mr. ROBERTSON, in reply, stated that the persons referred to in the question were properly insured as employed contributors until Dec. 30 last, when a special order came into force by which their employment was excluded from the scope of the compulsory provisions of the National Insurance Act as a class of employment which was ordinarily adopted as subsidiary employment only, and not as a principal means of livelihood. In the circumstances, the contributions paid by the men up to Dec. 30 could not be treated as having been paid under a misapprehension; and the Commissioners had no power to make any repayment from the National Health Insurance Fund in respect of such contributions. If, however, deductions had been made from the men's wages for any period subsequent to that date, an application for a refund, so far as these contributions were concerned, would be entertained in the case of any men who might not elect to continue in insurance as voluntary contributors.

Mr. LYELL: What is to become of the payments that were made before that date?

Mr. ROBERTSON said he must ask his hon. friend to give him notice of that question.

On Tuesday, Sir George Younger asked a similar question, and was referred by Mr. Robertson to the answer given on the previous day, as set out above.

Replying to another question by Sir George, Mr. Robertson said he was not in a position to give an answer to the supplementary question put by Mr. Lyell on the previous day.

Mr. LYELL: Are we to understand that the Insurance Commissioners are absolutely prohibited by the Insurance Act from making this repayment?

Mr. ROBERTSON: That is as the Act stands.

Mr. LYELL: Have they not the power under the "Power to Remove Difficulties" clause?

Mr. ROBERTSON: I understand not.

GRAYS AND TILBURY GAS BILL.

HOUSE OF LORDS COMMITTEE.—Wednesday, April 9.

(*Before Lord* LAMINGTON, *Chairman*, *Lord* BASING, *Lord* VAUX OF HARROWDEN, *Earl of* LEICESTER, *and Earl of* HARROWBY.)

This Bill proposes an important extension of the area of supply of the Grays and Tilbury Gas Company, having roughly a radius of twelve miles from the present gas-works. Additional capital powers to the extent of £150,000 in new ordinary shares are also sought. There was no opposition to the preamble.

Counsel for the Bill were Mr. J. G. TALBOT, K.C., and Mr. W. E. TYLDESLEY JONES. For the Port of London Authority and the Rochford Rural District Council, Mr. LYNDEN MACASSEY, K.C., appeared.

Mr. TALBOT, in opening, said the Company were originally founded in 1853 as a private concern to supply gas in Grays and Tilbury, and were converted in 1881 into a statutory undertaking. There were subsequently various extensions of the Company's area, and in 1907 an Act was passed under which the Company were now working, and which placed them under the sliding-scale. There were two standard prices—viz., 4s. 2d. per 1000 cubic feet within, roughly, a radius of a mile of the gas-works, and 4s. 10d. in the outer area. The capital also was divided into two classes—viz., "A" capital, which was entitled to a standard dividend of 10 per cent., and "B" capital, which was entitled to 7 per cent. Before there could be any increase in the dividends, however, there must be equivalent reductions in price in both areas. In other words, a reduction in price in Grays alone would not carry with it the right to an increased dividend on the capital. The actual prices at present charged were 3s. 8d. in the inner area and 4s. 2d. in the outer area. The dividend on the "A" stock last year was 8⅛ per cent. instead of the standard of 10 per cent., and on the "B" stock £5 10s. per cent. instead of the standard of 7 per cent. Thus the Company were not distributing so

large a dividend as they could do under their Act, but were giving the consumers the benefit, realizing that a broad commercial policy of this sort would in the long run be likely to be in the interests of both consumers and shareholders. It was anticipated that there were likely to be considerable industrial developments in many parts of the County of Essex surrounding the Company's existing area of supply; and this was the reason which had prompted the Company to ask for power to supply gas there, with the consequent necessary additional capital powers. He agreed that parts of the additional area were of a purely agricultural nature. It was necessary, however, to go through these in order to reach the others, and, according to practice, powers were taken to supply in these agricultural districts. In the additional area there were at present four small gas-works—viz., at Stanford-le-Hope, Billericay, Rayleigh, and Laindon—which were in the hands of three different Companies. The Stanford-le-Hope Company was a small statutory concern; the two works at Billericay and Rayleigh belonged to Mr. Worthington Church; and the Laindon works belonged to a limited Company supplying without statutory powers. The prices paid for gas in these places were higher than the present price charged in the existing outer area of the Grays Company; being 4s. 9d. in Stanford-le-Hope, 4s. 4d. in Billericay and Rayleigh, and 5s. in Laindon. Under the Bill, these four gas-works would be acquired; and the prices to be paid for them had been agreed with the owners. The intention of the Company was to transmit high-pressure gas from the existing works at Grays, and ultimately to dispense with the four independent gas-works—using them merely as distributing points. It was further the intention to supply in the new area at the same price as in the present outer district. There had been several petitions against the Bill, but the bulk of them were not appeared upon; while those opponents who did appear, were there in relation to clause matters.

The CHAIRMAN at this stage remarked that if there is no opposition to the ground plan, he did not think that it would be necessary to call witnesses.

Mr. TALBOT then went on to deal with the opposition of the Port of London Authority. The point which he had to deal with was with regard to a "Hard" or causeway connecting South Benfleet and Canvey Island, and which was the only means by which the Company's mains could be carried to Canvey Island. This roadway was covered at high-water mark and was only usable at low tide. Nevertheless, it was a public road. There were considerable possibilities of industrial development in Canvey Island. Only last session a dock scheme was promoted, which was, however, rejected. Nevertheless, there was at present no gas supply in the island; and the Company believed there would be a good demand there. The Port of London Authority claimed, and he believed correctly, that this causeway was their property. At any rate, they had some jurisdiction over it; and it was quite right that they should have some control with regard to the laying of mains over it. The Company were quite willing to give the Authority all the powers of a road authority under the Gas-Works Clauses Act of 1847. The Authority, however, wanted much more than this. They desired to have an absolute veto upon the laying of the main across the causeway, and, more serious than this, they wished to have an absolute right to prescribe the conditions under which the main was to be laid, which would give them authority to say that if at any time they desired the main to be removed it must be taken away. This, of course, would make it entirely impossible to supply gas in the island.

In answer to the CHAIRMAN, Counsel said that he understood the County Council and the District Council maintained the causeway, and that no expense was involved in this connection by the Port of London Authority. Continuing, he said that another condition of the Port of London Authority was that the Company should pay a rent for the use of the causeway, such rent to be determined under the terms of a previous Act granted to the Thames Conservancy. As he read the wording of the section in question, the Company might have to pay the whole of the revenue from the Canvey Island supply as rent. The Authority even objected to the Company having any right of objection from their decision as to the conditions upon which the gas-mains should be laid, however unreasonable these conditions might be.

Mr. *A. W. Sumner*, the Engineer and Manager of the Gas Company, and Mr. *F. E. Bartlett*, the Chairman of the Company, were called to prove that the causeway in question was a public roadway, and that the Port of London Authority were not actually the road authority with regard to it, although the Company were willing to give them all the rights of a road authority.

Mr. LYNDEN MACASSEY, addressing the Committee, said that the Port of London Authority were not seeking to prevent the Company from laying their mains under the causeway, or even to maintain them there for all time. What they did ask was that the present position of the Authority with regard to the River Thames should apply to this creek, which was, in fact, part of the navigable river. At present, it was necessary to maintain 5 feet of water over the causeway at high level. It was clear, however, that as time went on the size of barges using the creek might increase; and in that case the Authority maintained that they should have the right to say to the Company that the mains should be altered or removed at the Company's own expense. With regard to the proposed rent, there was no case in which a gas company had laid mains on the property of the Port of London Authority in which a rent was not paid; and he could draw no distinction between the river itself and this navigable creek.

Mr. *F. Ayliffe*, the Secretary of the Port of London Authority, gave evidence on the point bearing out Mr. Macassey's argument, and insisted that there must be a rent paid in this case.

Mr. TALBOT, in his reply on the position, said that there was no parallel case to this in the whole Port of London Authority's territory, and therefore to give the Company the powers they were asking could not create a precedent.

The Committee having consulted,

The CHAIRMAN said that they were of the opinion that the Port of London Authority could claim a vested right in the causeway, but thought that some agreement should be arrived at between Counsel for the better protection of the Company.

Mr. TALBOT asked the Committee if this decision meant that the Company were to pay a rent for carrying their main across the causeway.

The CHAIRMAN replied that this was so.

Mr. TALBOT: Then I am afraid that Canvey Island must go without gas, as this is a point on which the promoters cannot possibly agree.

An adjournment was then taken in order that the Committee might consider the point. After lunch,

The CHAIRMAN said the Committee had come to the decision that the Company, if they laid their mains to Canvey Island, must pay the Port of London Authority a rent.

Mr. TYLDESLEY JONES, on behalf of the promoters, thereupon asked the Committee to strike Canvey Island out of the Bill; and this was done.

Another objection was then raised by the Port of London Authority as to the possibility of the Company laying mains in other creeks which might be in their area of supply; and ultimately a clause was agreed to the effect that the Company should not, under this Act, without the consent of the Port of London Authority, lay any mains or pipes in the River Thames, or in any navigable creek or in any navigable tributary of the Thames.

Mr. TYLDESLEY JONES then dealt with the opposition of the Rochford Rural District Council, which, he said, was directed to obtaining a special testing-station at Rayleigh, which is some ten miles away from Grays, where there is at present the only testing-station in the Company's area. None of the other 41 local authorities in the area asked for a separate testing-station, and the only result of placing one at Rayleigh would be to involve the Company in additional expense. If the system were a low-pressure one, something might be said in favour of the proposal; but as it was to be a high-pressure system, the test could just as effectively be made at the works at Grays. At present, there was no testing-station at Rayleigh, as the Company operating there was a non-statutory one. When this Bill was passed, the Rochford Rural District Council would have the right to make a test at Grays; and this, in the opinion of the Company's advisers, was amply sufficient. It was practically certain that the gentleman who made the test for the Council would come from London or Southend; and Grays was much more accessible to these places than Rayleigh.

Mr. *G. Phelps* explained the difference between high and low pressure gas, and how a test with a high-pressure system is just as effective when made at a gas-works as if made at the end of the mains, for there was no depreciation in quality or pressure at the end. To maintain a special testing-station at Rayleigh would involve an annual expenditure of about £200, in addition to the initial cost of fitting up the apparatus.

Mr. MACASSEY, in cross-examination, suggested that high pressure gas was in its infancy; but witness reminded him that it has been in use for twenty years in the United States, and for ten years in this country. In any case, whether high pressure or low pressure, he personally did not think there was any necessity for a testing-station in Rayleigh.

Mr. *E. H. Stevenson* corroborated Mr. Phelps' evidence, and said that the cost of the apparatus would be from £250 to £300. Testing-stations were, in 99 per cent. of cases in this country, at gas-works themselves; and it was very seldom indeed that local authorities took advantage of the facilities afforded them if they had a special testing-station in their own district. For instance, at Grays there had only been one test in recent years; and he did not believe that a station at Rayleigh would be made even as much use of as that. He believed that, on the average, municipalities utilized their testing-stations about once in ten years.

Mr. *Bartlett*, the Chairman of the Company, was called and said that, within his recollection, the Grays Council had not tested the gas since 1907. The only test he remembered was when the Grays surveyor called at the gas-works and had to make the test under the direction of the Company's manager.

Mr. MACASSEY then opened his case by calling

Mr. *Arthur Valon*, the Consulting Engineer and General Manager of the Westgate Gas-Works, who expressed the opinion that it was perfectly reasonable for the Rochford District Council to require a testing-station in their area. He did not agree with the evidence that gas under a high-pressure system was bound to be precisely the same at the end of a long main as at the gas-works, because the gas-works test was invariably made before the gas was compressed.

Mr. TYLDESLEY JONES cross-examined witness to the effect that he had had very little experience of high-pressure supply. Witness admitted that his only experience was at Westgate, where the pressure was 10 inches, which, retorted Mr. Tyldesley Jones, was very little more than ordinary gasholder pressure. In the course of further questions, it was put to witness that the whole tendency of parliamentary practice in the case of large areas absorbing other works was to have the testing-station at the gas-works; and in this connection the Bishop's Stortford case was mentioned.

Mr. MACASSEY, in his speech to the Committee, said that the Rochford Rural District Council placed the greatest possible importance upon having a testing-station under their own control; and if it would meet the Company at all, he offered, on behalf of the District Council, to pay such proportion of the cost of the station as the Committee might think fit.

Mr. TYLDESLEY JONES having replied on behalf of the Company, and refused to accept the offer of the Council.

The CHAIRMAN announced that the proposal of the Rural District Council was rejected.

Thursday, April 10.

On the resumption of the proceedings this morning,

Mr. TYLDESLEY JONES mentioned that all points had been arranged with the Rochford Rural District Council, with the exception of the period of notice which the Company should give before opening-up roads. Under the Gas-Works Clauses Act, the Council were entitled to three days' notice; but it was suggested that they should have seven days, and this the Company strongly resisted.

Mr. MACASSEY urged upon the Committee the fact that three days' notice was quite insufficient to make the necessary arrangements

for the Company to open the roads, and pointed out that in the Bill already the period had been increased to seven days in the case of bridges.

The Committee refused the Council's application, and the Bill was ordered to be reported for third reading.

TYNEMOUTH GAS BILL.

HOUSE OF LORDS COMMITTEE.—Wednesday, April 9.

(*Before Lord* BALFOUR *of* BURLEIGH, *Chairman*, *Earl of* NORTHESK, *Lord* RAMSAY, *Lord* DE L'ISLE *and* DUDLEY, *and Lord* DAWNAY).

By this Bill authority is sought to extend the limits of the Company's supply in order to include, with the exception as to a small part, the Urban District of Whitley and Monkseaton and the Urban Districts of Earsdon and Seaton Delaval. The Company may charge for gas in the Urban District of Earsdon up to 6d. per 1000 cubic feet more than the charge in the Borough of Tynemouth and the Urban District of Whitley and Monkseaton, and up to 1s. per 1000 cubic feet more in the Urban District of Seaton Delaval. The most important part of the Bill, however, is Part III., which contains provisions relating to a co-partnership scheme.

Counsel for the Tynemouth Gas Company were Mr. A. WEDDERBURN, K.C., and Mr. H. COURTHOPE-MUNROE; and for the only opponent, the Tynemouth Corporation, Mr. R. H. FOX (of Messrs. Durnford and Co., Parliamentary Agents), appeared.

Mr. WEDDERBURN, in opening, said that the only part of the Bill which was now opposed was Part III., the opposition to the other portions having been disposed of. He explained that the Tynemouth Gas Company were a maximum price Company, and since 1867 had paid the maximum dividend; the price of gas now being 2s. per 1000 cubic feet. Coming at once to the co-partnership scheme, to which the Tynemouth Corporation objected, the material clause in this section of the Bill was clause 8, which read as follows:

(1) The Directors may, with the sanction of a majority of the shareholders present and voting at an extraordinary general meeting of the Company, prepare, put in force, and from time to time modify or alter, a scheme enabling employees, or any class or classes of such employees as may be defined in the co-partnership scheme, to participate in the profits of the undertaking as part of the terms of remuneration for the services of any such employee.

(2) Any agreement as to service with any employee in pursuance of any such co-partnership scheme may be entered into with any employee who has attained the age of sixteen, and shall be in writing, and may be made on the part of the Company under the hands of any two Directors or under the hand of the Secretary, or of any person from time to time appointed on that behalf by resolution of the Board of Directors.

Continuing, Counsel explained that no scheme was embodied in the Bill; but powers were taken to formulate a scheme which, of course, would be capable of modification under varying circumstances from time to time. It was impossible to stereotype a scheme of this character in an Act of Parliament. The sole object of the Directors in asking for the powers was to insure the smooth working of the undertaking, although, of course, they could have initiated a co-partnership scheme without parliamentary sanction, if they cared to run the risk of action being taken against them by a dissentient shareholder or consumer. The opposition of the Corporation seemed to be based on the fact that no detailed information was given in the Bill as to the nature of the scheme which it was proposed to set up. In their petition they denied the necessity for such a scheme, and urged that if it were set up the Directors would have to sanction and create a large amount of additional capital which could not be profitably employed in the legitimate business of the Company, and that, in consequence, the price of gas would have to be increased in order to provide the additional revenue required to pay the dividend on the additional capital. The answer to this was that the scheme was a necessity, and that it would not require a large amount of additional capital.

Mr. *W. Hardie*, the Manager and Chief Engineer of the Company, expressed the opinion that the power to establish a co-partnership scheme was a desirable one in the interests both of the Company and the consumers. He did not believe it would affect the price of gas, because he anticipated that, when the scheme got into working order, the undertaking would work more smoothly than under ordinary conditions. He believed this had been found to be the case with the working of the co-partnership scheme of the South Metropolitan Gas Company. Incidentally, he mentioned that the Tynemouth Corporation, who were opposing the proposal, were the Company's competitors as the owners of the electricity undertaking in the town; while competition was also experienced from the Newcastle-on-Tyne Electric Supply Company.

In reply to Mr. FOX, who cross-examined on behalf of the Corporation, witness said that no scheme had been prepared; but he thought that if and when such a scheme was adopted it should follow the lines of those which had been approved by other companies—such as the South Metropolitan Company, already mentioned. At any rate—no details had at present been worked out. He agreed that in all schemes of this character which now exist there was a provision that for every penny in the reduction of the price of gas a bonus should be paid to the employees ranging from ½ to 1 per cent., and that there was a further provision that half of the bonus should be retained by the company and invested in the ordinary stock of the company, or left on interest, with the object of giving the employees a permanent financial stake in the success of the company. He agreed that this was a very good provision, and he was willing to adopt it. The maximum price at Tynemouth was 3s. per 1000 cubic feet, and the actual price 2s.; but there was a slight deficit last year through selling at this low price. The Company's wages bill was about £20,000 a year; and he thought it was better to pay a bonus than to grant increases of wages. If the employees received a 5 per cent. bonus, the Company would have to provide an additional £1000 a year. He agreed that similar powers had only been granted by Parliament in four cases—namely, the Gaslight and Coke Company, the South Metropolitan Gas Company, the South Suburban Gas Company, and the Cambridge Gas Company. In the last case, the powers were granted subject to the Board of Trade approving the scheme.

Mr. WEDDERBURN, interposing, said that there was no case in which the details of a co-partnership scheme had actually been put in a Bill.

Mr. FOX agreed that this was so.

Mr. WEDDERBURN also pointed out that, with regard to the £1000 a year which it was said the Company would have to find, this would not, in fact, have to be found in actual cash, as the bonus would be given in stock, and therefore it would only be a question of the interest on £1000.

Witness, in answer to further questions, said that the Company had been threatened with labour troubles in the past, and he regarded a co-partnership scheme as a factor which would tend towards eliminating such troubles.

Mr. FOX, in addressing the Committee on behalf of the Tynemouth Corporation, said that it would not matter much to the consumer if a profit-sharing scheme were adopted, if the Company were a sliding-scale Company; but here it was a maximum-dividend Company—the maximum being 5 per cent.—and the whole of the increase in the Company's expenses due to the co-partnership scheme or any other cause must fall upon the consumer, unless the shareholders went short of their dividends, which, he suggested, they would not be magnanimous enough to do in order to provide a profit-sharing scheme for the employees. If in this case it was to be a scheme for a 5 per cent. bonus, it must mean that the price of gas would go up. Grantham, he mentioned, was a maximum-price Company with a profit-sharing scheme, but without statutory sanction. In that case they had adopted the principle of the sliding-scale; the provision being that if the price of gas was increased to 3s. 4d. there was no bonus, and if the price of gas was 3s. 3d. the bonus was 1 per cent. on the wages—the scheme providing for a variation with every penny taken off the price of gas. With regard to the schemes already authorized by Parliament, in the Cambridge Act the clauses corresponded to those in the Tynemouth Bill, except that there was no clause similar to clause 8, which authorized the Directors to establish an unlimited scheme. The entire thing was very much in the air; and he asked the Committee to strike out the whole of the co-partnership clauses, or else place upon the Company the necessity for receiving the sanction of the Board of Trade to any scheme before it was put into force. This course had been adopted in the case of Cambridge.

The CHAIRMAN said he was sorry that the attitude which the Corporation had thought it right to take up seemed to be to discourage the profit-sharing scheme. He would like to know whether the Town Council was in any way opposed to the principle of such schemes or only to the particular clauses in this Bill.

Mr. *Stanley Wilson*, the Town Clerk of Tynemouth, said that his Corporation did not object to the co-partnership scheme—in fact, they rather supported the principle. They were of the opinion, however, that the powers proposed under this Bill were far too wide, and might be prejudicial to the consumers of gas generally. The only difficulty, he understood, in the suggestion that the Company should receive the Board of Trade approval to any scheme was the expense of applying for the necessary Provisional Order.

The CHAIRMAN said the point seemed to be a very narrow one, as both parties were in favour of co-partnership, in the abstract, and the issue seemed to have been brought down to the point as to whether the Company should receive the powers before establishing a scheme.

Mr. WEDDERBURN said the Company wanted to avoid the expense of a Provisional Order, and were asking for exactly the same powers as had been granted to Cambridge, with the addition of clause 8. The question really was, Could the Committee trust the Directors?

Witness said that the Corporation had nothing to complain of so far as the present directorate was concerned, but directors changed.

The CHAIRMAN said that clause 8 gave the Company supreme authority.

Mr. WEDDERBURN agreed that he could not find any precedent for clause 8.

The CHAIRMAN said that, in the opinion of the Committee, there must be some authority to control or sanction any scheme that the Company might frame.

After considerable discussion, and a consultation during the luncheon interval, the parties agreed to the insertion of the following sub-section to clause 8:—

> No co-partnership scheme under this Act, nor any modification nor alteration thereto, shall be put in force until it has been approved by the Board of Trade, who are hereby empowered to vary any proposal so submitted to them, and one month before submitting a scheme, or any modification or alteration thereto, the Company shall send a copy thereof to the Town Clerk of the Borough of Tynemouth and the Clerks of the Urban District Councils of Whitley and Monkseaton, Earsdon, and Seaton Delaval, who shall thereupon be entitled to make to the Board of Trade any representations in writing, of which copies shall be sent to the Company.

The CHAIRMAN said the whole of Part III. of the Bill must be made dependent on the scheme being approved by the Board of Trade.

Mr. WEDDERBURN, in order to make this absolutely so, brought up the following new clause, to be added at the end of Part III.:

> This part of this Act shall have no force or effect unless the co-partnership scheme under this Act shall have been approved by the Board of Trade.

This disposed of the opposition to the Bill.

During the course of the adjustment of clauses, attention was called

to a report by the Local Government Board in regard to clause 27, which reads as follows:

> The Company may enter into any contract with any local authority, company, or person for a supply of gas to any premises within the limits of supply, and such supply may be given for such purposes, and subject to such terms and conditions as to price and otherwise, as may be agreed upon between the Company and the person taking such supply: Provided that the Company shall not, under the powers of this section, give any preferential price as between any consumers who shall take a supply of gas from the Company under similar conditions and circumstances.

Mr. COURTHOPE-MUNROE explained that South Shields, on the opposite side of the river, had been given this clause. He argued that the Tynemouth Company were entitled to it for this reason, and also having regard to the fact that the Tynemouth Corporation could offer electricity at different prices for different purposes and (if electricity was being taken in varying quantities) as between different consumers.

The CHAIRMAN said the Committee would allow the clause to remain in the Bill; but it would be subject to anything which the Chairman of Committees might have to say later.

The Bill was then ordered to be reported for third reading.

HARROW AND STANMORE GAS BILL.

The Unopposed Bills Committee of the House of Commons presided over by Mr. DONALD MACLEAN had before them on the 3rd inst. the Bill promoted by the Harrow and Stanmore Gas Company.

Mr. T. SEAGER BERRY (of Messrs. Sherwood and Co., Parliamentary Agents) explained to the Committee that the Bill was promoted by the Harrow and Stanmore Gas Company, with the object of consolidating the existing share capital into stock, to raise £250,000 additional capital, with corresponding borrowing powers, to allow the Company to use, for the purposes of their gas-works, land which they already have adjoining their existing works, and to make two bridges between the two pieces of land. There were also a number of small matters in the Bill relating to the creation of reserve and special purposes funds, and a benefit fund for, and profit sharing by, the employees. The proposal was to convert the ordinary £10 shares, which at present carried 10 per cent., into £20 stock bearing 5 per cent. interest; the result being that there was exactly the same dividend and exactly the same increase in dividend as at present.

Mr. *James L. Chapman*, the Engineer and General Manager of the Company, said that at present the whole of the capital authorized had been raised, and the reason for the additional capital powers asked was the extraordinary development now taking place in the Company's district, which he put at the rate of 12 to 16 per cent. per annum. The district was practically a London one, and there was not a penny left to be raised of the capital granted in 1903, with the exception of a few thousand pounds borrowing powers. The Company's output doubled itself in ten years.

Mr. MOON (Speaker's Counsel) asked a number of questions as to the necessity for such a large amount of capital.

Witness replied that the district comprised 36 square miles. The rate of increase at present would absorb the new capital in seven or eight years. The miles of streets were increasing very greatly for mains purposes; and this also would necessitate large extensions at the works.

Mr. MOON: I suppose your chief mains are laid?

Witness replied that this was so; but these mains were becoming almost impossible, and the Company were thinking of laying high-pressure mains, or else dealing with them in some other way.

The preamble of the Bill was then found proved.

PROVISIONAL ORDERS (No. 3) CONFIRMATION BILL.

UNOPPOSED BILLS COMMITTEE.—Thursday, April 10.

(*Before Mr.* WHITLEY, *Chairman, Sir* E. MOON, K.C., *the Speaker's Counsel, Sir* W. P. BEAL, K.C., *Mr.* DONALD MACLEAN, *and Mr.* STAVELEY-HILL.)

This Confirmation Bill includes Provisional Orders relating to gas matters, brief abstracts of which are given below.

ASHTON-IN-MAKERFIELD URBAN DISTRICT COUNCIL.

This Order authorizes the Ashton-in-Makerfield Urban District Council to utilize, for gas purposes, land, in addition to that scheduled in the Council's Orders of 1893 and 1906, and also gives them unlimited borrowing powers, subject to such loan being sanctioned by the Local Government Board. At present, the borrowing powers are limited to £45,000. Further, under the existing Orders, the maximum period which the Local Government Board can grant for the repayment of loans is thirty years; but this is extended to sixty years, as, for land, it was not felt that thirty years was long enough. It was pointed out to the Committee that the limits of supply were confined to the municipal area.

ROCHDALE CORPORATION.

This Order gives the Corporation powers to supply gas-fittings, the section reading as follows:

> The Corporation may purchase or hire and sell or let on hire, supply, and otherwise deal in and fix, set up, alter, repair, remove, and refix, but shall not manufacture, any gas-fittings, and may require and take such remuneration in money, or such rents and charges for, and make such terms and conditions with respect to, the sale, letting, supply, fixing, setting-up, altering, repairing, removing, or re-fixing of such gas-fittings, and for securing their safety and (if the circumstances so require) their return to the Corporation as may be agreed upon between the Corporation and the person to or for whom the said gas-fittings are sold, let, supplied, fixed, set-up, altered, repaired, removed, or refixed.
>
> Any gas-fittings let for hire under the provisions of this section shall not be subject to distress or to the landlord's remedy for rent, or be liable to be taken in execution under process of any Court or any proceedings in bankruptcy against the persons in whose possession the same may be: Provided that such fittings are marked or impressed with a sufficient mark or brand indicating the Corporation as the actual owners thereof.
>
> For the purposes of this section, the expression "gas-fittings" includes any meter, engine, oven, stove, range, pipe, or burner, or any other apparatus, appliance, article, or thing used, or intended or adapted to be used, in, or in connection with, the supply or consumption of gas for the purposes of lighting, motive power, heating, and cooking, or for any other purpose for which gas can or may be used.

SWANAGE WATER BILL.

The same Committee as above dealt with this Bill, which authorizes the Urban District Council to purchase the water portion of the Swanage Gas and Water Company's undertaking.

The Bill is in continuance of the terms of the Company's Act of last year, when the Council were given the right to purchase the Company's water undertaking if they promoted a Bill for the purpose this session. The sum of £42,000 has been spent on the water undertaking; and the Company possess four wells. One of these, however, has been condemned by the Local Government Board, while some suspicion attaches to another. Hence the Council are only purchasing two wells and the remaining plant and pipes, all of which is to be taken over on arbitration terms. There was a loss on the water undertaking last year, and it is anticipated that this will have an appreciable effect in keeping down the amount of the award. In the Company's Act last year, a large scheme was outlined for obtaining additional supplies of water from a spot some six miles away from Swanage; but borings near the existing wells have shown that there are ample supplies close at hand to last for several years. Nevertheless, the Council take over all the powers of the Company's Act of 1912. The Council asked for a period of 55 years in which to repay the loan to meet the amount of the award; but the Committee refused to grant a longer period than fifty years.

In this form, the Bill was ordered to be reported for third reading.

ELY VALLEY GAS AND ELECTRICITY BILL.

The Standing Orders Committee of the House of Lords dealt with this Bill on Thursday, in respect of an opposition by the Llantrisant Gas Company, to the effect that the Standing Orders had not been complied with.

The Bill proposes to incorporate a new Company with a capital of £45,000, in £10 shares, to supply gas and electricity in a number of parishes in the county of Glamorgan. The allegation of the Llantrisant Gas Company was that the notices relating to the Bill did not sufficiently describe the area of supply. The area scheduled in the Ely Bill comprised certain parishes in which the Llantrisant Company are already giving a supply.

Mr. LEES (Parliamentary Agent) contended that it was impossible from the notices relating to the Ely Bill to define the area so far as it affected his Company.

Mr. DODDS (of Messrs. Lewin, Gregory, and Anderson, Parliamentary Agents) argued that the insufficiency of the notices was not enough to justify the Committee in not allowing the Bill to proceed. Any person, by the aid of a local map, could have determined, from the notices, the exact limits proposed. The Llantrisant Company were fully aware of the scope of the Bill, and could not have suffered any injury.

Mr. LEES said there was a long list of cases in which Bills, in similar circumstances, had not been allowed to proceed.

After deliberation,

The CHAIRMAN (Lord Donoughmore) announced that the Standing Orders would not be dispensed with.

The Bill is therefore dead for the present session.

SILLOTH GAS BILL.

The Standing Orders Committee of the House of Commons last Wednesday decided to suspend the Standing Orders in the case of this Bill, in order to allow it to be presented as a late measure. The Bill authorizes the Holme Cultram Urban District Council to purchase the gas-works of the North British Railway Company in Silloth for the price of £2400, together with residuals, &c., and the mains, pipes, &c., at a value to be agreed, or, failing agreement, to be determined by arbitration.

Widnes Gas and Water Supplies.

At the Widnes Town Council meeting last Tuesday, Mr. Isaac Carr, the Gas and Water Engineer, stated that last year an extraordinary increase took place in the amount of gas produced and water pumped by the Corporation. Over 1262¾ million gallons of water were pumped; and notwithstanding the fact that the coal strike last year closed some works for four weeks, the pumping amounted to 165 million over the previous year. The water pumped during the past six months had been at the rate of 1339 million gallons per annum. The gas made amounted to 456,830,000 cubic feet, and this was 37,000,000 cubic feet in excess of the quantity made the previous year. Alderman Timmis (the Chairman of the Gas Committee) mentioned that, in view of these extraordinary increases, the Committee would be compelled to bring forward a scheme for the reconstruction of the works, at a cost of over £30,000.

LEGAL INTELLIGENCE.

PRICE OF GAS AT SKEGNESS.

Abortive Petition of Ratepaying Consumers for a Reduction.

At the Lindsey Quarter Sessions at Lincoln last Friday, the Magistrates had before them a petition of certain ratepaying gas consumers of Skegness for an order to be made upon the Skegness Gas Company to reduce their price.

Mr. T. H. WALKER, K.C., and Mr. ANDERSON (instructed by Messrs. Ridgway and Ridgway, of Dewsbury) appeared for the petitioners; Mr. HUGO YOUNG, K.C., and Mr. R. F. HAYWARD (instructed by Messrs. Tweed, Stephen, and Co., of Lincoln, the Solicitors and Secretaries of the Company) for the respondents.

Mr. WALKER, in opening the case, pointed out that the application was made on behalf of 140 petitioners, who felt that the price of gas at Skegness was excessive, having regard to the profits made, and should be reduced. He quoted the Acts of Parliament under which the Company obtained their powers, and stated that these limited both the dividends to be paid and the prices to be charged for gas. The matter arose out of the accounts of the Company for the year to Dec. 31, 1911, in which the profits were stated to be £1699 14s. 9d. From this, however, there were some deductions made, which brought down the £1699 14s. 9d. to £1557 11s. 5d. The Company paid in dividend £1214 14s. 7d.; and therefore they had in their coffers £342 16s. 10d. According to their own showing they had made a sum of money which would have permitted a substantial reduction in the price of gas. A second point was that in the revenue account sums appeared which ought not to be there—that the profits were, in fact, a great deal larger than they appeared to be. In the revenue account there were four items, totalling £417 os. 9d., which had been transferred from the capital; and this made the profit £417 less than it otherwise would have been. If his contentions on both of these points were right, there would have been a sum of £759 17s. 7d. available for the purposes for which the petitioners submitted they were applicable. Counsel went on to intimate that an order had been secured from the Court for an investigation of the accounts of the Company; and this had been made by Mr. John Wortley, of Sheffield. His report was read; and it bore out Counsel's contention that there were instances where expenditure had been placed to the revenue account which were properly chargeable to capital.

The CHAIRMAN inquired how Counsel was going to get over the passage in the section under which he had come to Court, which said that before an order to reduce the price could be made the petitioners must show that the company concerned had paid a dividend at the prescribed rate, and that they had a reserve fund properly invested at the specified rate.

Mr. WALKER admitted that he could not show that the Company had this reserve fund invested.

The CHAIRMAN said the matter then resolved itself into a question of costs.

Both Counsel addressed the Court on this point.

Mr. HUGO YOUNG contended that the petition was never of a *bonâ-fide* character, being such as might be instituted by people who had a design upon the Company, and wanted to have an investigation. The Act of Parliament, however, did not justify this course. The report of an independent accountant who had been called in having now been presented, it was obvious that there was no ground upon which such an order as was asked for could be made. Having failed to establish their claim to a reduction, the petitioners ought, he contended, to be made to bear the costs of the petition.

The Bench retired. On their return into Court,

The CHAIRMAN announced that they had come to the conclusion that there was not sufficient reason for bringing the petition. They directed that the cost of the accountant should be borne by the Company, but that the costs of the Court proceedings would have to be paid by the petitioners.

An order was made accordingly.

ALLEGED UNLAWFUL EXTENSION OF A MAIN.

HIGH COURT OF JUSTICE.—CHANCERY DIVISION.

Wednesday, April 9.

(*Before Mr. Justice* JOYCE.)

Whittington Gas and Coke Company, Limited, v. Chesterfield Gas and Water Board.

This was a motion for an injunction to restrain the defendants, their officers, servants, workmen, and agents, from laying, completing, or connecting a pipe or pipes in Foundry Street, Whittington Moor, in the county of Derby, or elsewhere in the parishes of Brimington and Whittington, so as to constitute an extension of an existing gas-main of the defendants, in contravention of the provisions of the Chesterfield Gas and Water Board Acts of 1895 and 1911, and from utilizing for the supply of gas any main laid in contravention of these Acts.

Sir A. CRIPPS, K.C., and Mr. F. H. MAUGHAM appeared for the plaintiffs; Mr. R. YOUNGER, K.C., and Mr. W. J. SCHOLEFIELD represented the defendants.

Sir A. CRIPPS said the plaintiffs were a private limited Company supplying a particular area in the parishes of Brimington and Whittington, which were within the area of supply of the Chesterfield Gas and Water Board; but as regarded the Board and their predecessors in title (the Chesterfield Gas and Water Company), there was a limitation that they were not to supply within the two parishes without the consent of the plaintiff Company. The plaintiffs said that, although under these Acts the defendants had been prevented from competing in the two parishes, they had laid mains and pipes, and were asserting that they had a right so to compete. Section 5 of the Act of 1895 provided that it should not be lawful for the Board to extend their mains for the supply of gas in the two parishes named, unless with the previous consent in writing of the Whittington Gas Company. This consent had not been given—in fact, the plaintiffs had protested in the strongest way against any such extension. By the Act of 1895, the powers of the Chesterfield Company were transferred to the Board, who had laid down a pipe along Foundry Street for a distance of 88½ yards in the parish of Whittington, in order to serve a customer who had hitherto been supplied by the plaintiffs; and they said they were entitled to invade the plaintiffs' territory, notwithstanding the proviso referred to, if they did it by means of a separate pipe to each customer, and so avoided the use of a main. The first answer to this was that there was no technical meaning to the word "main" in any of the Gas Acts. The contention of the defendants was that they were entitled to get the better of the plaintiffs, though they had promised not to come into their territory without consent. His submission was that there was no difference whatever between a main and a pipe.

Counsel then read an affidavit made by Mr. Herbert H. Everest, the Company's Manager, from which it appeared that the plaintiffs had a 3-inch main in Foundry Street and that the defendants had recently laid a 2-inch pipe from their main in Sheffield Road, and with it was connected a service-pipe which supplied gas to Green's Foundry, both for lighting and power purposes, and was therefore in direct competition with plaintiffs. The 2-inch pipe was laid in the position in which gas-mains were usually placed; and there was nothing to prevent the defendants from using it for supplying other persons. Mr. Arthur Henry Cæsar, the Company's Secretary, had also made an affidavit stating that the defendants were the successors of the old Chesterfield Gas and Water Company; that, by virtue of the provisions of the Act of 1895, their limits were to be the existing limits; but that they had recently laid a 2-inch main without obtaining the necessary consent.

Mr. SCHOLEFIELD then read an affidavit made by Mr. Simpson, who had been employed by the defendants since 1892. He said that the Chesterfield Company had at Whittington Moor a considerable number of consumers who were supplied with gas from the main in Sheffield Road, but, owing to the supply being insufficient, many had transferred their custom to the plaintiff Company. Recently Mr. Green had asked for a supply of gas; and, in order to comply with his request, the defendants had laid a service-pipe, which they had power to do under their Acts, but they had no intention of extending a main into Whittington—the pipe being laid for the *bonâ fide* object of supplying Mr. Green. Mr. W. T. Buckland, the Manager of the Chesterfield Gas-Works, said this was a "pipe," as distinct from a "main."

His LORDSHIP remarked that the pipe would undoubtedly become a main if two persons were supplied with gas from it.

Sir A. CRIPPS said he had an affidavit from Mr. H. E. Jones, the well-known gas engineer, who said that, in his judgment, a pipe laid along a street for the purpose of supplying gas could properly be described as a "main," no matter what its diameter might be.

Mr. YOUNGER pointed out that there was no definition of "main" in the Gas Acts, though there was in the Electric Lighting Acts.

Sir A. CRIPPS said if one looked at the proviso in section 4 of the Act of 1895, it was clear that the word "main" was not used in any technical sense. The object was to prevent defendants from competing with the plaintiffs in their own territory. If a pipe ran along a street, anyone whose house it passed would have a perfect right to a connection.

His LORDSHIP: Do the defendants admit that the pipe is their property, and that people whose houses it passes have a right to be connected with it?

Mr. YOUNGER said where premises were 25 yards from a main the expense of putting in a service-pipe was borne by the consumer and the company in certain proportions.

Sir A. CRIPPS said the pipe was laid under the provisions of the Gas-Works Clauses Act, 1847, which enabled a pipe to be laid along a street. Whose property it was might be a nice point, though he should suggest it was the defendants'.

His LORDSHIP said he did not see his way to making upon a motion such an order as he was asked to make; and he suggested that the question should be determined at the trial of the action, when all the facts would be before the Court.

Sir A. CRIPPS said if there was any point which ought to be further elucidated, he should not object to this proposal; but he thought all the facts were upon the affidavits.

Mr. YOUNGER said if the plaintiffs were right, the Court could order the defendants to take up the pipe, or restrain them from supplying gas.

His LORDSHIP: Not on motion. The question could only be satisfactorily disposed of at the trial, when the witnesses had been examined and cross-examined. The motion would stand over till the trial; and he hoped that, in the meantime, the defendants would not supply other people with gas from the pipe in question.

Mr. YOUNGER said they had no intention of doing so.

SUPPLY OF WATER TO SEPARATE HOUSES.

HIGH COURT OF JUSTICE—KING'S BENCH DIVISION.

Thursday, April 10.

(*Before Justices* RIDLEY, PICKFORD, *and* AVORY.)

South-West Suburban Water Company v. Hardy.

This was a special case which was before the Court some months ago [see "JOURNAL," Vol. CXVIII., p. 529], and was sent back to the Justices to be restated.

Mr. MACMORRAN, K.C. (with him Mr. JOSEPH), for the appellant Company, said the Justices of the Brentford Division had found that the Company were charged with unlawfully refusing to furnish a supply of water to certain houses in Southall, known as Nos. 91 to 103, Featherstone Road, for which the rate had been tendered. They

convicted the Company, fined them £5, and ordered them to pay the costs. The case raised the point whether a person was entitled to demand the continuance of a supply of water to a number of houses by means of one common service-pipe or by a seperate pipe to each house. The respondent raised the point that, under the provisions of Forrest Fulton's Act, the Company had unlawfully cut off the supply, and could not call upon him to provide a separate pipe for each house; and the case was sent back for the Justices to find the circumstances under which the water was cut off. It was urged by the respondent that, instead of discontinuing the supply, the Company's right procedure was to get a charge upon the premises. The respondent was the owner of the seven houses in question, the ratable value of each being £11 10s. All the houses had, since 1895, been supplied with water by means of a single service-pipe. Owing to the respondent being in arrear with his payments, the water was cut off in September, 1911. The amount due was afterwards sent, with a request that the supply might be restored; and the Company expressed their willingness to make the connection provided a separate service-pipe was laid to each house. This requirement not having been complied with, proceedings were instituted; and the Justices held that, the respondent having for eighteen years received water by means of a single service-pipe, the Company were not justified in treating him as a new applicant when he had paid arrears and had tendered the rate in advance. By the case as re-stated, the Justices found that down to the time of cutting off the water every demand note in respect of the houses had been delivered to the respondent; and that from the time the houses were built he was the only person whose name appeared in the books of the Company in respect of the water-rate. They further found that the circumstances of the laying on of the water were that an arrangement, which constituted an agreement between Mr. Hardy and the Company, was come to by which the houses should be supplied with water and the rate compounded; that, although the rate was raised in 1910, the agreement was varied to that extent only; and that therefore the cutting-off was unlawful. They also found that the consideration for the agreement was that the Company were secured in respect of the rate, and relieved of much trouble in its collection, and were paid the rates whether the houses were occupied or not. On the authority of *Sheffield Water Company v. Wilkinson* (decided in 1879), the appellants contended that they were justified in insisting that there should be a separate service-pipe to each house, and that as they had not refused to give a supply the conviction could not stand.

Mr. G. R. Hill, for the respondent, submitted that the case as re-stated virtually put the appellants out of Court, as it was found that Mr. Hardy was not a new, but an old, customer; and the regulation as to having a separate service-pipe did not therefore apply. He further contended that the regulation insisted upon was unreasonable.

Mr. Justice Ridley said he was of opinion that the decision appealed from was right, and must be affirmed. In cutting off the supply of water, the Company committed an unlawful act, and in refusing to reconnect it until their regulation was complied with they put themselves in the wrong. He much doubted whether the Company could make a regulation of this general nature under the order which gave power to frame regulations for preventing the waste or misuse of water. Anyhow, it was impossible for the appellants to say they had a right to call upon the respondent to provide a separate service-pipe, and that until he did so they would not give him a supply of water.

Mr. Justice Pickford concurred. Without expressing any opinion as to whether the regulation was retrospective or came within the scope of the words of "preventing waste or misuse of water," he thought the Company had wrongfully cut off the supply, and that the respondent was entitled to request that the water should be laid on again. This the Company would not do unless he complied with the regulation. He had a right to dispute the regulation, and have it ascertained whether or not it was a reasonable one, and also to have water in the meantime. The Company, by their own wrongful act, could not put themselves in a better position than they were in before cutting off the water.

Mr. Justice Avory agreed.

The appeal was consequently dismissed with costs.

ALLEGED BREACH OF A COAL CONTRACT.

Last Tuesday, in the Commercial Court, King's Bench Division, of the High Court of Justice, Mr. Justice Scrutton reserved judgment in the action of *Michael Pintus and Sommerfeld, Limited, v. H. S. Higginbottom, Limited*, the trial of which had occupied several days.

Mr. Leck, K.C., and Mr. Crawford appeared for the plaintiffs; Mr. Leslie Scott, K.C., and Mr. Raeburn for the defendants.

Plaintiffs sought to recover £3500 as damages for alleged breach of contract for the supply of gas coal. It appeared that in July, 1911, plaintiffs entered into a contract with the Turkish Government to supply, at Constantinople, 15,000 to 20,000 tons of Arley gas coal for use in the Turkish Government Gas-Works, at the price of 14s. 10½d. per ton. The coal was to have the quantity of gas and coke and illuminating candle-power contained in an analysis sent by plaintiffs to the Turkish Government. The contract was subject to the condition that plaintiffs were to ship to the Government one cargo of the coal, and that the coal so shipped was, on examination, found to be in accordance with the analysis. Defendants contracted to sell to plaintiffs from 30,000 to 40,000 tons of the Arley gas coal, or other coal to be in all respects equal, the coal to be composed of one half screened coal and one half small; the cost being 8s. 6d. per ton f.o.b. High Level, Liverpool, cash against bills of lading. The price was, however, to be reduced to 8s. 3d. per ton if the contract for supplying bunker coal to the steamers carrying the coal from Liverpool to Constantinople was given to defendants. Plaintiffs alleged that it was an express term or condition of the contract that the coal would be in accordance with, or approximately equal to, an analysis which showed the gas made per ton of coal carbonized 10,840 cubic feet corrected for temperature and pressure; illuminating power, in standard candles, 18·95 with a No. 2 burner and 16·10 with a No. 1 burner; coke made per ton, weighed dry, 12 cwt. 3·71 lbs.; ash in coke, per cent., 6·88; analysis of coal, moisture 2·5 per cent.; volatile matter, 26·3 per cent.; carbon, 66·6 per cent.; ash, 4·6 per cent. It was a term of the contract that the contract was entered into subject to the first sample cargo being satisfactory, and that plaintiffs were not to be liable for dock or town dues, but all such dues were to be paid by defendants. Plaintiffs further alleged that the coal shipped was not in accordance with the analysis, and thereby they had lost the benefit of repeat orders.

The defendants denied that they agreed to sell coal in accordance with any analysis, or that the analysis had reference solely to the quality of coal quoted at 11s. 3d. per ton. The analysis was an analysis of particular qualities of coal, and not of consignments consisting of large and small coal mixed. They further said it was not an express or implied term of the contract that they should pay town or dock dues; and they denied that they knew of the terms of the contract between plaintiffs and the Turkish Government. They also denied the alleged breach of contract, and pleaded that the coal shipped was of the quality and description contracted for, and was in accordance with the contract.

As mentioned above, judgment was reserved.

Metropolitan Water Board's Assessment Appeal.

At the Surrey Quarter Sessions last Friday, the Metropolitan Water Board appealed against the assessment of their intake and pumping-station at Walton-on-Thames. The grounds of appeal were stated to be: (1) That the Assessment Committee had wrongly included £2800 for special adaptability of the land for the Board; (2) that the annual value was estimated on a wrong principle; and (3) that no deduction had been made from the estimated value in respect of ornamental work, which did not increase the usefulness of the works or contribute to their annual value. The assessment against which the appeal was made was £10,500; and the appellants contended it should be reduced to £5338. The cost of the land and works was £152,520, and the Board said that as they were able to raise the money at a little less than 3½ per per cent., it was only right the assessment should be based throughout upon this figure. The amount spent on embellishments was £8963; and it was contended that this was spent for the preservation of the amenities of the district and under pressure from the Local Authority. The Court found: (1) That the undertaking should be dealt with under the ordinary rule of 5 per cent. for buildings and 4 per cent. for land; (2) that no undue expenditure had been incurred in respect of embellishment; (3) that there was nothing to be added to the assessment in respect of the adaptability of the land. The appeal was allowed, with costs; and the assessment was reduced from £10,500 to £7785. The Court, however, agreed to state a case.

Municipal Electrical Competition.

In the course of a Local Government Board inquiry at Halifax, opposition was offered by Mr. E. Haley (the President of the Ratepayers' Association), who brought forward several points deserving consideration. The inquiry was with regard to an application by the Corporation for sanction to borrow £18,180 for the purposes of the electricity undertaking. Mr. Haley said that no allowance was made by the Corporation for depreciation; and he also urged that, although the average cost to the Committee of producing electricity was 1½d. per unit, they were selling to large consumers at ⅞d. per unit. This involved them in serious loss; and, furthermore, it was very detrimental to the Gas Department. By selling current at a loss, the Committee were displacing gas-motors, and capital belonging to the gas-works was consequently being thrown out of use. The result was that, during the last five years, they had increased the output of electricity by 40 per cent., but the corresponding income increase was only 14 per cent. This 40 per cent. increase had produced a revenue of £5500; but the increased expenditure was £8366. Expenditure had gone up 25 per cent., while the revenue had only increased 14 per cent.; and the unprofitable work they were now doing would land the town in serious loss. He opposed the application for the extension of plant in the interests of the borough. It might be very good—and perhaps was—for the power users; but for the general ratepayer, it was mischievous, and led to ruin. The Inspector (Mr. T. C. Ekin) suggested that the one important fact was that there was a profit from the undertaking each year. Mr. Haley: By ignoring any depreciation of plant. The Inspector: There are a large number of undertakings that do not set aside specific repayments of capital charges year by year. That, of course, is a matter of opinion. I do not say I do not agree with you, to a certain extent; but there are many successful municipal undertakings which do not set aside any fund for depreciation. Councillor Fawcett remarked that they might trust those who gave their time to the work to do the best they could in the interests of the ratepayers. The Committee, before they adopted the power charges, took everything into consideration. They could produce the current for the money. Before long, they hoped, they would be able to get the charge down to ½d. per unit. There were undertakings now selling it at this figure.

New Joint Stock Companies.—Under the title of "Coal Products, Limited," a Company has been formed with a capital of £25,000, in £1 shares, to acquire certain inventions and applications for British patents therefor (No. 28,791, Dec. 14, 1912, and No. 3375, Feb. 10, 1913), and an exclusive licence for the application of "a process for the production of light oils from crude heavy or lighting oils in connection with any products obtainable from coal." One of the Directors is Mr. Julius Moeller. The State of Alagoas Water and Drainage Company, Limited, has been registered with a capital of £500,000, in £1 shares, to carry on the business of water-works' contractors, drainage engineers, sinkers of wells, constructors of dams, maintainers of reservoirs, filter and purification beds, &c.; and to acquire a concession granted by the State of Alagoas for the acquisition, construction, and operation of a system of water-works and drainage in the city of Maceio and its suburbs.

MISCELLANEOUS NEWS.

GAS SUPPLY OF PARIS LAST YEAR.

The current number of the "Journal des Usines à Gaz" contains some particulars, reproduced from the "Bulletin Municipal Officiel," in regard to the consumption of gas in Paris last year, and the revenue resulting therefrom. The figures are given in the following table :—

	Year 1912. Cubic Metres.		Inc. on 1911. Cubic Metres.		Per Cent.
Total output	471,331,543	..	18,786,529	=	4·15
Consumption.					
City of Paris	33,371,336	..	1,392,719	=	4·36
Private consumers—					
At 20 c. per cubic metre	408,931,920	..	18,506,815	=	4·73
At 15 c. ,, ,, ,,	6,422,090	..	359,839		
	448,725,346	..	20,259,373	=	4·73

Receipts.	Francs.		Francs.
City of Paris	5,005,701	..	208,908
Private consumers	82,749,697	..	3,755,339
	87,755,398	..	3,964,247

The increase in the consumption was equal to about 715 million cubic feet, and in the revenue to about £158,570. The unaccounted-for gas last year did not exceed 22,606,197 cubic metres (798 million cubic feet); whereas in 1911 it reached 24,079,041 cubic metres (or about 847 million cubic feet). This was equal to a reduction to the extent of 6·1 per cent. on the quantity of gas unaccounted for in 1911.

LIVERPOOL LIGHTING ENGINEER'S REPORT FOR 1912.

Public Lighting.

In the last number of the "Journal" (p. 121), some figures were given from the report of the Lighting Engineer of Liverpool (Mr. A. G. Smith) for the year ended Dec. 31 last in regard to the automatic lighting of the city. The following are some additional particulars from the report.

It appears that the suburbs have now been completely provided with controllers. Prior to their installation, these areas were lighted by means of 5990 lamps; but the number has since been increased to 6692. Notwithstanding this increase, the wages have been reduced by approximately £2500 per annum; and as this represents about one-third of the total number of lamps throughout the city, Mr. Smith says an amount of at least £7500 may be expected to be saved from this source alone when the work is completed. Seventeen new districts were formed during the past year—making a total of 40.

In consequence of the installation of automatic controllers, the lamp-lighting staff has been reduced, and the work at the end of the year was being carried out by eight foremen and 111 lamplighters—a total of 119, against 152 at the close of the previous year. The average number of lamps dealt with by each lighter in the old city was 108. Four additional lighters and three automatic lamp attendants became entitled during the year to the extra 1s. per week for ten years' meritorious service. The total number receiving this merit pay is now 95, made up as as follows: Foremen, 8; lighters, 61; automatic lamp attendants, 26.

The length of roads lighted by gas at the close of the year was: Old city, 267¼ miles; suburbs, 199 miles—total, 466¼ miles. In the old city there were in use at the end of the year 12,628 lamps; in the suburbs, 6692 lamps—total, 19,320 lamps, or an increase of 83 on the number at the corresponding period of 1911. Of the electric lamps used for lighting the city, 192 were arc, and 729 metallic filament—together, 921. The total length of roads lighted at the end of 1912, irrespective of courts and passages, amounted to 474¾ miles—8 miles being by electricity, 458 miles by incandescent gas, and the remaining 8¾ miles (principally back streets) by the ordinary flat-flame system.

In the unadopted streets and passages, 87 single incandescent gas-lamps have been erected in 3 miles of streets, and 22 flat-flame burner and 15 single incandescent gas-lamps in thirty passages, at the expense of the owners. The revenue derived from this source during the year amounted to £462 12s. 6d. The lighting of 5¾ miles of road was rearranged during the year, involving the erection of 103 electric, 9 double, and 34 single incandescent gas-lamps, and the removal of 67 existing lamps to new positions; while 110 lamps were removed to new positions owing to the widening of roadways and sidewalks, alterations to property, and other causes. There were 47 single incandescent gas-lamps fixed in lieu of flat-flame burners, five columns in lieu of brackets, and 39 in lieu of broken ones. In addition, 22 new single incandescent gas-lamps were erected in three-quarters of a mile of adopted streets.

Gas and Meter Testing.

During the year, tests of the illuminating power of the gas were made with the No. 2 "Metropolitan" argand burner, with the results given below (column A). Mr. Smith points out that the illuminating power under the new conditions was 18 candles, as tested by the old standard burner—No. 7 steatite batswing (see column B).

	A. No. of Tests.	Average Illuminating Power. Candles.	B. No. of Tests.	Average Illuminating Power. Candles.
Office	309	21·43	309	17·02
District	107	21·07	107	15·93

In accordance with an arrangement come to with the Gas Company, tests of the illuminating power of the gas were made at several of their works prior to the test on the district; the average results of 85 tests being as follows: "Metropolitan" burner, 20·55 candles; steatite burner, 17·47 candles. Periodical tests were also made with the "Metropolitan" burner at the Fazakerley Gas-Works; the average result of 52 tests being 19·74 candles. For calorific value, 588 tests were made; showing an average of 560·84 B.Th.U. net per cubic foot of gas. Mr. Smith says this may be considered satisfactory under the new conditions. For specific gravity, 279 records were taken; the average being ·541.

There were taken in various parts of the city 421 samples of gas, and analyses of them were made at the laboratory. The average of the tests indicated the presence of 12·9 per cent. of carbon monoxide, representing an admixture of 27·2 per cent. of carburetted water gas; but Mr. Smith states that as much as 20·6 per cent. of carbon monoxide, representing an admixture of 60 per cent. of carburetted water gas, was found at Garston; the average of the tests in this portion of the city being 16 per cent., representing an admixture of 40·4 per cent. of carburetted water gas. He has forwarded the results of all these tests to the Medical Officer of Health. Tests were also made for the presence of sulphur compounds, &c., and likewise for pressure.

There were 47 tests during the year of consumers' pipes and fittings; and the following table indicates the extent of the escapes found. It will be seen that only 4 per cent. of the pipes and fittings tested could be certified as sound.

Escaping at the rate of—	Number of Tests
From 1-10th to 9-10ths of a cubic foot per hour	25
From 1 to 5 cubic feet per hour	16
12 cubic feet per hour	1
16½ ,, ,,	1
20 ,, ,,	1
21 ,, ,,	1
Sound	2

During the year, the Department dealt with 5719 reports of failures in the gas supply to public lamps due to the presence of naphthalene. Complaints were made to the Gas Company from time to time; and Mr. Smith says he has been assured that every effort has been made to reduce the stoppages to a minimum.

The work in the Meter-Testing Department was of an exceptionally heavy character last year; the number of meters tested (16,411) and the fees received (£595 6s.) being the highest on record. Mr. Smith says this was due principally to the establishment of a new meter manufactory in Liverpool, for which 5358 prepayment meters were tested. The following are the details of the meters tested during the year :—

Liverpool United Gas Company—		
Ordinary Meters—		
Certified	7689	7812
Rejected	123	
Prepayment Meters—		
Certified	2086	2199
Rejected	113	
Parr Manufacturing Company—		
Prepayment Meters—		
Certified	5201	5358
Rejected	157	
Sundry (including Birkenhead and Wallasey Corporation—		
Prepayment Meters—		
Certified	755	1042
Rejected	287	
Total		16,411

The number of electric meters tested during the year amounted to 4057, of which 1335 were rejected. The fees received amounted to £68 15s., to which must be added the sum of £220 paid by the Electricity Supply Department.

Expenditure.

The total charges in connection with the public lighting of the city and the supervision of the gas supply for the year amounted to £54,743. A revenue of £3549 was derived from work charged to other departments and bodies, including a large portion of the gas-fitting work of the Corporation, which last year was unusually heavy owing to the erection of artisans' dwellings and the fixing of incandescent gas-burners in Council schools. The net expenditure was therefore £51,194.

TOTTENHAM GAS COMPANY AND ELECTRIC LIGHTING.

Approval of the Transfer of the Wood Green Order.

The ratepayers of Wood Green have, through the local Citizens' Association, endorsed the action of the Wood Green Urban District Council in their decision to transfer their Electric Lighting Order to the Tottenham and Edmonton Gas Company. The adjourned meeting of the Association took place last Thursday evening, to consider the resolution of Councillor Holmes (the only member of the Local Authority to oppose the action of the Council) in support of the application of the North Metropolitan Electric Power Supply Company for an Order to supply Wood Green. The previous meeting was held on March 13, as reported in the "Journal" for March 25 (p. 878).

Councillor Holmes considered that the proposal of the Gas Company to pay the Council £500 for an absolute lighting monopoly entailing £50,000 a year was a miserably small sum. A more reasonable sum would have been £5000, because the transaction carried with it the backing of the District Council. Much would be made of the fact that the Gas Company were reducing their prices and serving the district well; but while they were lowering the price, they were also reducing the candle power of the gas, and consumers were now only getting 14-candle power, as against 16 candles some time ago. It was

not in the interests of the district that the Gas Company's Order should be granted, mainly on the ground that the absence of competition would be undesirable.

Councillor Hext remarked that the Electric Company had made no offer for the Order, and that the Gas Company's scheme would bring in several hundreds of pounds a year in rates.

Mr. F. W. Parsons said he had made a careful study of the subject; and in view of the better conditions offered by the Gas Company, he would support the amendment, moved by Mr. W. Denney at the previous meeting, in favour of the Gas Company.

Mr. E. G. Cole, a member of the Middlesex County Council, said that, owing to the lower standard of gas, he had to have the whitewashers in more often now than a few years ago. He had no love for either Company; but he was sure it was not good for the district to shut out competition for all time. There would be an end to the incentive to supply better lighting in Wood Green. Through the trams, the local ratepayers had an interest in the Electric Power Company; and it was to their advantage to support them. The rating question was comparatively of no importance.

Mr. Bigge could not understand why the Electric Power Company had told Wood Green their Order was worth nothing when they were ready to take Orders for such scattered places as Rickmansworth. It was ridiculous for the Power Company to complain about the Council negotiating with the Gas Company, after having refused the Order themselves. Mr. Barnes considered that the question of competition was at the root of the whole question.

Mr. Denney said he did not believe the Electric Power Company were in earnest in their endeavour to get an Order for Wood Green. To his mind, all they wanted to do was to "dish" the Gas Company. Presuming that they were in earnest, he was confident that their prices would not be lower than, if as low as, those offered by the Gas Company. On the other hand, the Gas Company were under compulsion to supply in twelve months; while the Power Company were not under any such obligation. Personally, he should have preferred a Council supply, and failing this he favoured two competing companies; but the facts in the present instance were so decidedly in favour of the Gas Company that he had not the slightest hesitation in adhering to his amendment.

In reply to an assertion by Councillor Holmes, that the Council were getting £500 from the Gas Company for their support before a Parliamentary Committee, Councillor Ardley said the £500 was to go towards the expenses in connection with the Order. Councillor Holmes said the motive at the back of the Gas Company's mind was to buy the support of the Council in a fight against the Power Company. The prices quoted by the respective Companies for supplying current were not to be looked at from the same point of view. The Power Company's 8d. per unit was subject to gas competition; but the Gas Company's 5d. was not subject to any such competition. The Power Company had not attempted to "subsidize" the local Press; but the Gas Company had had whole-page advertisements in two or three of the local papers.

The voting was easily in favour of the Council's transference of the Order to the Gas Company.

THE FATALITY IN A SEWER AT NOTTING HILL.

Asphyxia from Coal Gas—Coroner's Testimony to Unselfishness.

At the Coroner's Court, Kensington, on Monday last week, Mr. Luxmore Drew resumed the inquiry relative to the deaths of Robert Frederick Libby and William M'Laren, members of the London Fire Brigade, and William Parry, sewerman, on the 18th ult., which took place under circumstances already recorded [see *ante*, p. 45]. It will be remembered that at the first hearing medical evidence was given to the effect that death was due to coma resulting from carbon monoxide poisoning; Dr. Spilsbury stating, however, that this did not necessarily mean coal gas.

Mr. Beasley Robinson (of Messrs. Monier-Williams, Robinson, and Milroy) and Mr. J. W. Godfrey again represented the Gaslight and Coke Company and the London County Council. Mr. W. Chambers Leete, the Town Clerk of Kensington, and Mr. A. R. Dyer, the Superintendent of the Fire Brigade, were also in attendance.

Mr. *A. R. Finch*, Assoc.M.Inst.C.E., Borough Engineer and Surveyor of Kensington, produced some plans showing the proximity of the gas-main to the sewer, and said that if the surrounding soil was permeated with gas, a great portion of it might percolate through to the sewer.

Henry Bloomfield, scout or look-out man, said some of the sewermen went down the sewer at eight o'clock on the Monday before the accident, came up at ten, and complained of an escape of gas.

Theodore Blakiston, a sewerman, deposed that the deceased man Parry said on Tuesday, the 18th, that there was a gas leak somewhere, and he was going to find it. Two men, named Hermitage and Langford, went with him. Langford shortly afterwards called for help, and on witness going down he found the three men lying at the bottom of the sewer. With assistance, he got all out except Parry.

George Washington, another sewerman, said he helped to get out Langford and Hermitage, and was within 10 feet of Parry when he became unconscious, and had to be taken to the hospital. He returned and went down the sewer again with Libby and M'Laren. Some time afterwards the ground was opened and the bodies were taken out.

William Hermitage and *Thomas H. Baker*, Chief Clerk of the works on the Kensington Borough Council, and *Arthur R. Dyer*, Divisional Officer of the Metropolitan Fire Brigade, and several firemen, having given evidence,

William Harrowell, Service Foreman in the employ of the Gaslight and Coke Company, said that if an escape of gas occurred in a sewer it was notified to him, and he reported it verbally or by telephone to the office, which was open day and night. He first heard of an escape of gas on Tuesday, the 11th of March; and on the day of the accident he went down to open a trench. Hermitage and Parry came up to him and said they smelt gas in the sewer at the junction of Pembridge Villas and Pembridge Place. They tried a searcher and an indicator, as well as another instrument, but could not get any clue. Brown and Eldridge then entered the sewer. They went some distance, when Parry shouted for help, and said he was "done." Hermitage and some sewermen went to his assistance. After a few minutes, one of them returned and said all the others were overcome. Mr. Baker and his assistant arrived at one o'clock, and the first man was got out, and the others after two or three minutes' interval; but the fifth man could not be reached. The Fire Brigade was summoned by the police; but the two firemen who entered the sewer with smoke helmets were dead before they could be got out. The fracture was discovered about 3.20 p.m., and repairs were commenced at once. The sewer was reached about 6 p.m., and the body of Libby was found about 2 yards north of the opening.

By Mr. Robinson: A search was made all round the footway, and a leak detector was put in; but no trace of gas could be discovered. They went down about 80 feet. When they opened the ground, they found the escape came from a very slight fracture, hardly discernible by the naked eye, in a 3-inch pipe. The pipe was apparently in a very good condition, laid in clay, and the subsoil above the main was loose and porous. The last time he heard about an escape of gas was on the 11th of March, when an inspector went down the sewer and made a report; but he (witness) did not know what was said in it. He tried with the indicator several times on the 11th of March, but could not get any trace or smell of gas. He saw Mr. Dowsing, the builder, there on the following Thursday, and suggested it was sewer gas.

By Mr. Chambers Leete: He suggested to Mr. Dowsing that the drains should be tested. He had no doubt the fracture was a recent one, which occurred not more than 24 hours before the discovery.

Similar evidence having been given by Mr. *Robson*, District Main Inspector, and Mr. *J. W. Brown*, Assistant District Inspector,

Mr. *Henry S. Reeson*, Distributing Engineer of the Company, said he visited the scene of the occurrence on the 18th of March, just before two o'clock, and was told that a man had been overcome at Pembridge Villas. The Fire Brigade were then in charge. On examination, he found there was, at 9, Pembridge Place, an escape of gas, caused by a fracture of a cast-iron main about 2 feet below the ballast. The pipe might have been broken for probably two or three weeks, and there would, of course, be an accumulation of gas. He thought he could give an actual estimate of the quantity that had escaped, as he had an experiment carried out on the preceding day to determine this point. It was made with a 3-inch main split for one-third of its diameter. The experiment being carried out in the open air, the escape of gas was, of course, considerably more than if surrounded by subsoil. A special test meter was used, for the purpose of ascertaining the quantity of gas issuing from the split; and he found about 20 cubic feet of gas was passing. The main had been laid something like fifty years. He was afraid the smell of gas in the sewer would not be much guide as to a fracture, because the odour of the sewer gas would very much disguise it. He did not know of any certain means of distinguishing coal gas from sewer gas otherwise than by the instrument he had brought with him [produced]. There were in the fracture one or two blowholes which were not visible outside the pipe. It was a very good pipe, and it must have been to have lasted so long. Where the difference between the specific gravity of air and gas was so small, it would be impossible to detect it.

By Mr. Robinson: It would be impossible to detect any fracture except from the smell of gas through gullies, and then through the service-pipes into the wall. One could not look at the mains as it would cause too much dislocation of traffic. The depth of the main was 1 ft. 10½ in. The Company, of course, always recognized the traffic problem as a very serious one. A greater danger was run with the heavy motor traffic than before. It would be a matter of consideration in the future as to what was to be done with the old mains, because the Gas Company and the local authorities were both interested in the safety of the public. As a matter of fact, his opinion was that, in the case under investigation, the pipe was broken by climatic conditions—change of atmosphere.

The Coroner, in summing up, remarked that the one thing which had struck him throughout the whole of the inquiry was the absolute unselfishness of all concerned.

The Jury deliberated for a quarter of an hour, and then returned the following verdict: "We find that William M'Laren and Robert Frederick Libby met their deaths by asphyxiation due to coal gas while engaged in the Pembridge Place sewer in attempting to rescue William Parry, who also met his death from coal gas poison in the the same sewer. We would recommend that some definite regulation should be compiled by the Borough Engineer to guide the sewermen in reporting immediately an escape of gas. We wish to express our admiration for the great gallantry shown by those members of the Fire Brigade, the sewermen, and others, who, at the peril of their own lives, descended a dark and narrow sewer for the purpose of rescuing human life; and we also desire to express our sincere sympathy with the relatives of the deceased."

East Dereham Water-Works Extension.—The Urban District Council of East Dereham having applied to the Local Government Board for sanction to borrow £1500 for the purchase of land adjoining the water-works and the extension of the works, Mr. Courtenay Clifton, one of the Inspectors, held an inquiry recently at the Council's offices. Mr. B. H. Vores (the Clerk to the Council), after giving the customary statistical information, stated that the loan applied for was to cover the cost of the purchase of rather more than 7 acres of land hitherto rented by the Council and let for allotment purposes. The purchase price was £300. A portion of the area was required for the erection of three new precipitation tanks. The water of the district contained a considerable amount of iron; and in order to dispose of the sediment the Council adapted Clark's process of treatment. The extra three tanks would enable 75,000 gallons of water per day to stand for the time required for proper precipitation. The loan was also to meet the cost of the borehole pump and a suitable covering for the tanks.

A "ONE COMPANY" EXHIBITION.

[From the April "Bulletin" of the British Commercial Gas Association.]

The subject of our illustrated supplement this month is one in which every member of this Association is keenly interested, and which has much in common with the objects, organization, and methods of the Association.*

The object of the National Gas Exhibition as the "JOURNAL OF GAS LIGHTING," in a very able and helpful editorial, recently remarked, is not merely (nor even mainly) that of celebrating events, important as, in the eyes of the industry, are the events which it will celebrate—the Centenary of Statutory Gas Supply, and the Jubilee of the Institution of Gas Engineers. Its prime object is to increase the sale of gas by increasing the knowledge of the public as to its manifold uses and advantages, and by providing the antidote of truth for the poison of slander which the enemies of the industry sedulously and insidiously spread abroad.

Its organization is compounded of representatives of the gas-making, gas-selling, and gas-appliance and plant manufacturing sides of the industry—a similar triple alliance to that which exercises such effective influence through the medium of the Association. Its methods will be to attract and to interest the public by making clear to man, woman, and child—through display, demonstration, illustration, lecture, and advertisement—the extensive and important part which the applications of gas play in both domestic and industrial economy, and the intimate relation between its use and many problems of public and private life—of national and individual health, of domestic service, of home comforts, and of business efficiency. The exhibition will, in fact, be at once an epitome and an enlargement of the work of the Association; and it behoves every one of our members to do his very utmost to ensure its complete success.

What can each one do?

The answer is a not unfamiliar one: Help the Executive to find the wherewithal, by bringing your undertaking into the subscription list; or, if that be already done on a generous scale, then by persuading others to do the same.

This brings us to the point at which it is necessary to make clear and to emphasize the unique character of the enterprise in hand, which, as the "JOURNAL" rightly remarks, "is a big thing—the biggest in its line the British gas industry has ever tackled; and the plans for it are unprecedented in character."

The uncommon character of the scheme of the exhibition is expressed in the title of this article. It will be an exhibition organized by, paid for by, and designed to benefit, one company only. There will be no competing elements, in the usual exhibition sense; only an honourable rivalry by each member of the firm to do his best for the whole. The exhibition will not be a congeries of stands of competing firms, showing over and over again goods so similar in design and purpose as to confuse and weary the public. It will be a co-ordinated exhibit designed to demonstrate under practical conditions how gas can be harnessed to the needs of man, woman, and child.

There will therefore be no space rentals, and, as the subscribing gas undertakings will be entitled to free admission for 80 of their consumers for every £1 subscribed, there will be very little gate money. The Executive have therefore to bear all the expense of rent, lighting, attendance, and construction throughout (which, as will be seen from the preliminary plans published in the supplement, will be a very costly affair), as well as of lectures, music, entertainments, and attractions of all descriptions, without having any income other than from the subscription list, to which the manufacturers of plant and apparatus have already guaranteed more than space, equipment, and attendance cost them at Earl's Court.

The exhibition, in short, is being planned and paid for by the one firm of Gas and Company (British Isles), 1913; capital—minimum, £25,000, but unlimited requirements; capital redeemable and dividends payable in permanently increased business.

The subscription list, for London and the country, is now open, and will close on or after the 1st of November next. Every £1000 subscribed over and above the amount required to pay the absolutely necessary expenses will more than proportionately add to the power of the exhibition to benefit—as it must benefit to a lesser or greater extent—every gas undertaking and every firm in the allied industries throughout the length and breadth of the country.

A unique opportunity presents itself for infusing new life and prosperity into the gas industry of the British Islands. The spirit of broad-minded co-operation, which is ready and eager to work with all and for all, has awakened and is fast spreading its influence; the councils of the industry are displaying in an ever-growing measure that commercial statesmanship which plans and works, not merely for to-day or for to-morrow, but for the years to come, and which has faith and foresight, as well as prudence and carefulness.

Who and where is he that is willing to stand aside and say: "I will have no part or lot in this?"

F. W. G.

An Appeal to the Manufacturers.

The same number of the "Bulletin" contains the following article, under the above heading, by Mr. F. W. Goodenough.

I should like to draw the special attention of members of the Society of British Gas Industries to the appeal made to them by Sir Corbet Woodall, in his Presidential Address on the occasion of their annual meeting last month, for more general and generous support of this Association.

In our last financial year we received just over £2000 from the members of the Society (against £10,500 from gas undertakings); and more than one-half of this sum came from one section of the Society—the stove makers. Yet, as Sir Corbet Woodall pointed out, the result of increasing the sale of gas by active publicity work just as surely brings increased business to the manufacturers of gas-making and gas-distributing plant as it does to the manufacturers of gas-consuming appliances, though not so immediately nor so obviously.

That the work of the Association has resulted, is resulting, and will in a growing measure result, in an increased sale of gas throughout the country and abroad is now very generally recognized. I would, therefore, on behalf of the Executive, urge very strongly the claims of the Association to the liberal support of every firm in the British gas industry. I do this with the greater confidence after observing the splendid way in which the whole of the firms in the "Allied Trades" have united to support the co-operative scheme for the National Gas Exhibition.

The gas undertakings of the country will be subscribing during the current financial year—*i.e.*, the year ending the 30th of September next—at least £13,500 to our funds. There are some 112 firms belonging to the Society of British Gas Industries, only one-half of whom subscribed anything to the funds of the Association last year.

Is it too much to hope that, in the matter of the Association as of the exhibition, the Society will put down for the good of the whole industry at least as much as the gas undertakings? For myself, I entertain a firm belief that the matter has only to be considered by each firm for the desired result to be achieved.

The Association could spend, with marked advantage to the industry, at least £50,000 instead of £15,000 a year; and the result obtained for every additional £1000 spent beyond the comparatively small sum now being expended would be progressively greater than that obtained from the last, because it is the cumulative effect of advertising that tells.

As the result of one full-page advertisement in the "Daily Mail," 450 inquiries respecting hot-water apparatus were received by one post from all over the country; and no work could be done in the office during the day it appeared except attend to callers and answer inquiries by telephone.

For want of money, such business-pulling advertisements can only be inserted at rare intervals. Given adequate funds, the Association could create such a stimulus to the gas trade everywhere as would astonish a good many people.

The members of the Society of British Gas Industries are business men, ready to spend money to make money; but, individually, they cannot carry out an effective campaign for increasing the sale of the commodity that is the basic element of their trade. The Association provides the way. If the manufacturers, as well as the undertakings, will find the means, the end will soon be attained—increased business all round.

Bearing upon the subject of the preceding article, it may be pointed out that in the "JOURNAL" for the 22nd of October last (p. 286) the object aimed at by the Chairman of the Executive was brought forward n a communication by "R. W. E.," entitled "Thoughts—After Manchester," in which the belief was expressed that manufacturers of gas apparatus would speedily take steps to adjust the discrepancy between the amount of their subscriptions to the Association and those of the gas makers.

Metropolitan Water Board's Deficiency Rate.—The "London Gazette" for last Friday contained a notice by the Metropolitan Water Board of their intention to apply to Parliament for authority to remove doubts as to their power to issue precepts, under the Metropolis Water Act, 1902, for payment of deficiencies in the water fund in respect of the years ended March 31, 1909-12, inclusive. Incidentally, the position of the various contributory authorities is to be defined. It is sought to make provisions as to the valuation lists on the basis of which the amount of the aggregate deficiency is to be apportioned among the contributory authorities, and likewise with respect to such apportionment.

The Fractured Gas and Water Mains at the West-End.—It is gratifying to find that no serious explosion followed upon the fracture of the three gas-mains in Brewer Street, Regent Street, to which reference was made in the "JOURNAL" last week (p. 122). As soon as news of the occurrence reached the Horseferry Road, men were promptly dispatched to the spot to stop-off the supply of gas. The ground gave way about one o'clock in the morning, and by half-past eight all the mains were "bagged." Three hours later the ends were capped. A temporary connection was made between the ends of the largest of the fractured pipes (6-inch), and a supply of gas afforded. The whole job was performed promptly and safely; and the Company's emergency staff who carried it out are to be congratulated on the result.

Mechanical Stokers for the Dukinfield Gas-Works.—A Sub-Committee of the Gas Committee of the Dukinfield Corporation have lately been investigating the question of the introduction of a mechanical stoker at the gas-works. Tenders were received from three firms, and that of Drakes Limited, of Halifax, for £2290, was recommended for acceptance. It was also decided that the Committee should provide their own electric plant. At the ordinary meeting of the Committee, the action of the Sub-Committee was approved. The matter came up for confirmation at the monthly meeting of the Town Council on Monday last week, when Mr. Bown questioned the policy of introducing a mechanical stoker, as it would do away with several manual stokers. He did not see why this should be done, seeing that the gas-works were doing very well indeed. If there was any money to spare, it should be handed over to the relief of the rates, and then every ratepayer would join in the benefit of it. Mr. Cooke said the Committee expected to save money by the change; but this was not the only consideration. There were other advantages connected with the machine. The minutes were adopted.

* The supplement contains particulars of the forthcoming National Gas Exhibition, accompanied by the sketches of the Machinery and Industrial Hall, Model Houses, and Banqueting Hall which appeared in the "JOURNAL" for the 18th ult., for the loan of the blocks of which due acknowledgment is made.—ED. J.G.L.

EXAMINATIONS IN "GAS ENGINEERING" AND "GAS MANUFACTURE."

Polytechnic Question Papers.

We give below the questions set before the candidates in the examinations on the above subject at the Regent Street Polytechnic, the classes at which are conducted by Mr. Alwyne Meade, Assoc. M. Inst. C.E. The examination in the Honours Grade was held on the 7th inst., and in the Ordinary Grade on the 9th inst. In both cases the candidates were directed not to attempt more than six of the eight questions set.

HONOURS GRADE.

1. How are the products of the distillation of coal affected by the temperature of carbonization? Discuss the effect of heat on the ultimate quality and quantity of the gas obtained, and state the advantages derived from completely filling the retort with coal.

2. (*a*) Discuss the relative advantages of carbonization in horizontal and vertical retorts, with special reference to practical comparative results which have appeared in the recent Technical Press. Give figures showing the proportion of coke used as fuel in both systems; and, in the case of vertical retorts, state the effect on the make of gas, &c., when steam is admitted at the bottom of the charge. How do carbonization costs (per 1000 cubic feet of gas made) compare for the two systems?

Or (*b*) In the event of your being left in charge of a works which ceased gas making from 6 a.m. to 6 p.m. on Sunday, what precautions would you take to ensure smooth working and the production of a gas of good quality? State how the charges, furnace dampers, exhauster, &c., would be regulated, and what steps you would take to prevent the formation of a vacuum in any part of the apparatus.

3. Describe briefly the various means employed for reducing the quantity of sulphur compounds (other than SH_2) in the gas. In the case of "limed coal," what quantity of lime is used for each ton of coal, and where is the greater portion of this ultimately found? State what is meant by "backward rotation" in oxide purification, and what advantages are claimed for it?

4. Describe briefly, with sketches, some form of conveyor as used for dealing with hot coke. State the advantages of the type you describe and the power required to drive it. What automatic means is employed for taking up any slack due to extension of the chain?

5. What do you understand by a thermo-couple? Explain how its principle is made use of in modern high-temperature pyrometers. What is the sensitive element employed in the direct reading Féry pyrometer (non-electric type)? Write down the working temperatures of: (*a*) A water-gas generator and superheater. (*b*) A combustion chamber of a regenerative furnace. (*c*) An ascension-pipe.

6. What are the main considerations to be kept in view in the construction and working of a sulphate of ammonia plant in order that effectual working may result? What is the approximate quantity of 8 oz. liquor, 70 per cent. acid, and lime required for the production of one ton of sulphate? How do you account for yellow and blue discoloration of the salt?

7. A steel gasholder tank is 150 feet in diameter. Calculate the intensity of internal bursting pressure due to the water at depths of 10, 20, and 25 feet from the top. Hence find the thickness of plates you would employ at these points (neglecting effect of rivet holes). What do you understand by "factor of safety," and what would you consider a reasonable factor for the material used in the above tank?

8. A gas-engine consuming 420 cubic feet of gas per hour has an indicated horse power of 25, the break horse power being 21. Calculate the thermal and mechanical efficiency of the engine, and sketch the form of an indicator diagram for such an engine running under good conditions, clearly showing the approximate cylinder pressures attained. What do you understand by "negative work," and how is this represented on the diagram?

ORDINARY GRADE.

1. Give the name of some Durham gas coal with which you are acquainted, and state the approximate yield of gas, tar, liquor, coke, and breeze you would expect to obtain from one ton of the coal. State also the probable yield of sulphate of ammonia and cyanogen in lbs. per ton. If a coal contains 4·2 per cent. of hydrogen, 8·3 per cent. of oxygen, and 2 per cent. of nitrogen, what is the proportion of unoxidized hydrogen present? Why is the latter of importance?

2. A retort-house with through bench of retorts is to be erected on a site where the nature of the ground is unknown. State what steps you would take for ascertaining the character of the subsoil, and what form of foundation you would employ for the bench if the upper stratum consisted of unstable clay, and gravel was not found until a depth of 18 feet had been reached.

3. Give a line diagram of a regenerative furnace of the single type. State the reactions which occur in the various parts of the furnace, and show that a definite quantity of carbon, whether burnt first to CO and then to CO_2, or direct to CO_2, evolves an equal quantity of heat in either case. What is the approximate temperature of a combustion chamber in a furnace of the above type?

4. Sketch some form of hydraulic main and dip pipe, clearly showing the means by which a liquor seal is obtained. Show also how the main would be supported above the bench, and state any precautions which must be taken when setting it up.

5. Write down the formulæ for the normal and acid salts resulting from the combination of ammonia with carbonic acid and sulphuretted hydrogen. State what you mean by saying that liquor is of "N" ounces strength, and distinguish between "free" and "fixed" ammonia. How much NH_3, CO_2, SH_2, and CS_2 would you expect to find in the gas at the outlet of the condensers?

6. Give an analysis of ordinary coal gas and carburetted water gas, and show how you would calculate the calorific power of the former from its constituents. What practical considerations must be kept in view in order to ensure the efficient working of a carburetted water-gas plant, both as regards the production of the "blue" gas and its carburation?

7. A gasholder is 100 feet in diameter, 65 feet high, and is composed of two lifts. The total weight of the lifts is 130 tons, and the lute contains 3500 gallons of water. Calculate the maximum pressure (in inches of water) thrown by the holder. What would be the intensity of the internal bursting pressure on the tank at a depth of 15 feet below the surface?

8. A retort-house stage floor 15 feet in width is composed of 10 in. by 5 in. M.S. joists. Owing to the longitudinal cross joists, concentrated loads of 2 tons are thrown upon the main joists at 3 feet spaces. Assuming each main joist to be a simply supported beam, sketch the bending moment and shear diagrams under this system of loading. What would be the allowable working stress in material of this kind assuming a factor of safety of five?

ELECTRICITY SUPPLY IN LONDON.

Paper by Mr. Frank Bailey at the Royal Society of Arts.

At the Meeting of the Society of Arts last Wednesday, a paper on progress in the supply of electricity in London during the past twenty years was read by Mr. FRANK BAILEY, M.Inst.C.E. The following are the portions which have the most interest for "JOURNAL" readers.

Mr. Bailey began by pointing out that he placed before the Society in the year 1890 a short account of electric lighting in London; and he said his intention in the paper was to endeavour to bring the information up to date. He then briefly sketched the progress of lighting in the ensuing years, and gave a table showing in a summarized form the present position of the various electricity supply authorities in London. It contained the following figures:

	Capital Expended.	Units Sold. 1911.	Units Sold. 1912.*	Maximum Load Winter 1911-12. Kilowatts.
Companies . .	£14,613,196	163,203,264	177,323,258	103,980
Local authorities . . .	6,602,055	94,445,100	114,708,000	59,130
Totals . .	£21,215,251	257,648,364	292,031,258	163,110

* Estimated.

In order to complete the statement, so as to include all electric supply, the author referred to the various railways and tramways operated by electric traction, and estimated as follows the total amount of electric energy utilized for all purposes:

	Units.
Railways	271,500,000
Tramways	130,000,000
General supply	277,500,000
Total	679,000,000

Between the years 1889 and 1904, every unit of electricity sold at from 6d. to 8d. could be utilized to obtain light up to 250-candle power for one hour by using carbon lamps, or (say) 36 candle-power-hours for 1d. Now, by using the tungsten lamp at the present charges for supply, one unit will provide 833-candle power for one hour, or (say) 208 candle-power-hours for 1d. In other words, the consumer obtains about six times the light for the same investment.

Referring to the use of electricity for power, Mr. Bailey said that the Electric Lighting Act of 1888 did not contemplate the use of the electric motor, which was then made only in small sizes, and its great future was not realized by the public. But from 1890 to 1900, its utility was generally recognized, and pioneering efforts resulted in its gradual adoption and final universal use. He thought the slow progress made at first might be traced to the reluctance of power users to abandon expensive steam plants which were not worn out, and which were frequently of quite recent design. When these plants gave trouble, or required repair or extension, the user was tempted to try a small electric motor as an experiment; and the result was so convincing that not only have steam and other plants been removed, but a greater amount of power has been substituted. The electricity supply authorities in 1906 combined to make an exhaustive canvass of all factory power users in London, and ascertained that the total amount of power required in all districts within the County of London was 208,806 H.P., or (say) 156,600 kilowatts. The total connection for electrical power now amounts to about 135,000 kilowatts, or 86 per cent. of all the power required.

London is at present supplied with electricity from 38 generating works. Many of them are equipped with plant of the latest design and best economy, and have facilities for extension at low capital cost. Some have sites of the utmost value to the future supply of London. All the existing works have still some useful life left in them; and the author considered that by a comparatively small expenditure they could be maintained in a high state of efficiency. Many of them are, however, limited in their ultimate resources; and when they have exhausted the utility of the present plant, it may be better to concentrate development on the more advantageous sites.

Having dealt with the works for the supply of electricity, the author turned, for purposes of comparison, to those established for the supply of gas and water. With regard to the former, he showed by a diagram on the screen that the position of the works and distributing centres ensures continuity of supply, with satisfactory results in economy and return on the capital expended. The position of the gas companies, according to "Field's Analysis," for the year 1911, was as follows:—

Company.	Nominal Capital.	Sale of Gas. 1000 Cubic Feet.
Commercial	£2,606,065	3,295,000
Gaslight and Coke	29,154,146	25,485,000
South Metropolitan	8,325,340	12,604,000
South Suburban	831,363	1,455,000
Wandsworth and Putney . . .	548,262	1,161,000
	£41,465,176	44,000,000

Mr. Bailey drew attention to the fact that these companies are not

subject to any powers of purchase, and have unlimited tenure, holding a practical monopoly in their respective districts. But he pointed out that they are "under terms of statutory supervision and limitation of dividends by the operation of a sliding-scale, which forms the most ideal protection for the public, and the best encouragement for business enterprise." The supply of water is similarly obtained from a number of sources, and distributed from many reservoirs. In 1904, the Metropolitan Water Board acquired by purchase the undertakings of the original eight water companies for the sum of £47,750,000, and now supply about 82,000 million gallons per annum. It will thus be seen that the capital expended at the present time on electrical undertakings is approximately one-half of that spent on gas and water works respectively.

The use of electricity for domestic purposes was the next branch of the subject taken up by Mr. Bailey. He remarked that "the brilliance of the tungsten lamp, accompanied by the low cost of obtaining increased candle power, has raised the standard of domestic illumination, and created a demand for more light. This demand would have serious effects on the eyesight if lamps of such high intrinsic brilliancy were exposed in an unscreened state within the direct range of vision. Fortunately, shades and screens of improved design and material are available at small cost; and methods of bowl lighting have been developed with the assistance of new forms of glass which give better dispersion with less absorption of light." He added that a supply of electricity is now essential to secure the greatest convenience in carrying out the ordinary domestic work of the home. Vacuum cleaners remove dust before it has time to accumulate; the electric iron is quickly heated, and remains at a safe temperature without getting dirty; electric cooking-stoves relieve anxiety; electric motors drive the sewing-machine, boot-cleaner, coffee-grinder, and other kitchen plant. Other uses of electricity cited were radiators and ozonizers.

Having shown how the suppliers of electricity have successfully pioneered its application for producing power, the author gave the following typical examples of the use of the electric motor for trade purposes:

Trade.	Kilowatts Connected.	Cost of Supply per Annum.	Trade.	Kilowatts Connected.	Cost of Supply per Annum.
Printing—			Biscuit factory .	265	£419 2 6
Newspaper .	1036	£1812 2 6	Confectioners .	174	569 11 9
General. . .	56	119 7 11	Rubber factory .	222	219 16 5
Box makers . .	9	80 0 10	Saw mill . . .	79	302 8 2
Chemists . . .	92	221 11 4	Spice factory .	69	371 4 4
Brewers . . .	39	153 10 6	Cabinet maker .	87	302 15 2
Paint factory .	108	253 2 11	Ironfounders .	150	877 14 2
Soap makers .	110	68 16 9	Vinegar brewery	15	201 14 10
Glass ,, .	18	118 16 0	Marble masons .	101	294 2 0
Blouse ,, .	13	89 6 4	Tobacco m'fac'rs	22	138 3 5
Wood wool mak's	166	623 8 6	Cold store . .	164	922 2 9
Packing-case ,,	52	214 17 10	Flour-mills . ,	51	158 15 11
Tailors . . .	63	159 15 5	Ink ,, . .	48	235 2 10

The average cost for each kilowatt connected in the representative cases given in the table works out at £2 15s. 8d. per annum, or (say) £2 1s. 6d. per horse power per annum. Mr. Bailey remarked that if this power had been obtained from the old-fashioned engine, with the losses in shafting, belting, and steam-pipes, starting-up the plant, and keeping the boilers warm all night, and the additional labour required, the cost would have been from £6 to £8 per annum, with further costs for continual repairs and all the annoyance of running steam plant taking up more room than it was worth.

Coming to the important question of street lighting, Mr. Bailey remarked that the development and perfection of the motor vehicle had resulted in increased speed of street traffic, which, while possessing many advantages, was attended with some danger; and in order to maintain safely this increased speed during hours of darkness, a higher standard of artificial illumination had become necessary. Improved street lighting was receiving consideration by the various borough councils in London; and their engineers and surveyors had recognized the value of better illumination, not only to ensure the safety of night street traffic, but also to improve adjoining property and to assist the police.

With regard to the conditions of supply and rates of charge for electricity, Mr. Bailey said the average price in London for the year 1910, given in the statistics issued by the London County Council, was 3·42d. per unit for lighting and 1·16d. for power, or a general average of 2·54d. per unit, including meter-rents. In Chicago, with a population of 2,250,000, there were sold last year 141,752,000 units for lighting, at an average price of 5·85 c. (say 3d.); and 86,875,000 units for power, at an average price of 3·88 c. (say 2d.)—the total sale of 228,627,000 units giving an average of (say) 2·62d. per unit. In Berlin, the charges are: For lighting, 40 pf. per kilowatt-hour, with a minimum charge of 100 kilowatt-hours per annum (say 4·7d. per unit); for power, 16 pf., with a minimum charge of 400 kilowatt-hours per annum (say 1·88d. per unit). In addition, there are charges for fixing and hire of meter, and for the cost of the house connection, with a further charge for the compulsory inspection of wiring at the rate of 4 per cent. on the actual cost of the installation. In Paris, the authorized rates of charge are 4·8d. per unit for lighting and 2·9d. for power.

In drawing his paper to a close, Mr. Bailey remarked that the present and future prospects of the company undertakings in London provided some possibility of undesirable speculation. The uncertainty of a purchase clause might encourage pessimist rumours to depress the property, to be followed by equally good reasons for a convincing boom, to the delight of the speculator. Shareholders might be well advised to place confidence in the justice of the ultimate arbitrator. He concluded by expressing a hope that the next paper on the subject he had dealt with—to be read (say) twenty years hence—would prove that the substantial progress made up to the present time was a sure indication of further great developments and the more extensive use of electrical supply.

In the course of the discussion on the paper, the Chairman (Mr. A. A. Campbell Swinton) commented on its interesting and exhaustive character. Referring to the future of the electric lighting industry, he remarked that the aspect of affairs was not without seriousness. What would happen, he asked, for some years before the London County Council made the contemplated purchase of the existing undertakings? There would probably be great difficulty in finding capital for extensions towards the close of the present period of holding. This was one of the evils of eventual municipal purchase upon the terms arranged for in the Electric Lighting Act. People would cease to find money for investment in a concern liable to be bought up at a very low price within a few years; and, in the speaker's opinion, the last Electric Lighting Act had not adequately provided for the difficulty which would arise in a few years' time. Mr. J. H. Rosenthal alluded to the value of the paper from a technical standpoint, its importance historically, and its character as an addition to the literature of the subject. Mr. W. C. P. Tapper supported the previous speakers in their appreciation of the completeness with which the author of the paper had dealt with his subject.

An interesting contribution to the discussion was made by Mr. L. Gaster, who congratulated the author on his interesting paper, and expressed his appreciation of the remarks on the importance of good illumination. The future prosperity of electric lighting was, he said, bound up with the study of scientific methods of illumination, and considerable progress was now being made. In Cheapside and other streets in the City of London, for the lighting of which Mr. Bailey was responsible, great improvement has been achieved. He (the speaker) had recently visited many of the chief Continental and American cities, and he believed that if the lighting of the City were completed on these lines it need not fear comparision with any of them. The Royal Society of Arts had always been keenly interested in lighting matters. Sixty years ago, the "Journal" of the Society had reproduced the report of the Committee on Industrial Pathology on trades which affected the eye; the report being signed by Dr. T. K. Chambers, Mr. John Simon, F.R.S., and Mr. T. Twining, jun. He would quote one passage: "It should be easy and inexpensive to arrange lights in such a manner that the illumination should be good and the workpeople not distressed by heat and glare. The vigour and energy with which work would be carried on in the cool, well-lighted, well-ventilated apartments would satisfactorily prove that attention to such points would be as conducive to the interests of the employer as to the health and comfort of the employed." It was most interesting to observe how, sixty years ago, the question of the proper shading of lamps was being considered, though only the comparatively low brilliancy and candle power of the flat-flame gas-burner were available at that date. To-day, when there were such vastly more powerful lamps in use, these problems were more urgent, and would doubtless receive the attention of the Committee recently appointed by the Home Secretary to deal with industrial lighting.

In his reply, Mr. Bailey said it had been a source of satisfaction to him to be able to bring up to date the figures he had given twenty-three years ago. Referring to the cost of electricity, he remarked that consumers generally had not shown any unwillingness to pay the rates imposed.

BOMBAY GAS COMPANY, LIMITED.

Increase of Business and Capital Expenditure.

The Ordinary General Meeting of the Company was held last Thursday, at the London Offices, Moorgate Station Chambers, E.C.—Mr. H. E. Jones in the chair.

The Secretary (Mr. A. Dickson, jun.) read the notice convening the meeting; and the Directors' report and accounts were taken as read.

The Chairman said he was like the wandering tinker, in Laurence Sterne's book, who, when asked for a story, replied, "Bless you, sir, I have no story to tell." The year had not been such an eventful one as the previous year or two. In the preceding year, there was the visit of their Majesties the King and Queen to India; and Bombay was included in the tour. There was, in consequence, a good deal of life and trade there; and the Company shared in the general additional business. The increase in the sales of gas that year was very considerable—as much as 9 per cent. In the past year, as the report told the shareholders, there was an increase; but it was only about 2 per cent., compared with the 9 per cent. of the year before. But when one had a flush year, and an extraordinary event like a Royal visit, one must not expect the same rate of increase to continue. However, the profit on the year was sufficient to enable the Board to recommend a balance dividend of 4½ per cent. (making 7½ per cent. for the year), which left a sum of £5744 to carry forward. The report also informed the shareholders that the Directors had issued, by tender, a further £20,000 of capital, and that upon the sale of the shares there was a premium per £5 share of £1 1s. 2d. Turning to the accounts, it would be noticed that the capital expenditure had been increased by £15,167. This might to some seem rather much for the amount of the extra trade the Company had done. He always liked, if possible, to balance the growth of his business with the growth of his capital. But they could not do this, because they were just completing works which had not contributed to their earnings, and which were required to meet future increases. The expenditure was partly for what was practically a duplication of their gas producing and purifying power; and the storage for gas had also been considerably increased during the year. The figures for these works appeared in the total of £15,000 odd. There was further valuable outlay for new mains and meters on the district (which meant additional gas consumers), amounting together to £7975. By this amount it would be seen that there was really an extension which would be potential in greater growth in the future, because the year that the mains and services were being laid, and the meters were being fixed, they could not expect to have any business from them. The Directors had purchased additional land, which had cost £2519, and which was parallel with the present works, and alongside the railway. They were therefore

in a very good position in respect of land; and in the event of Bombay proceeding with the new docks and the further enclosure of shireland, and with other developments, the Company would have plenty of area at their disposal for dealing with the new business that must come, although at the present time they had a large margin of works and distribution power. In addition to this, the accounts showed that the Directors had been liberal in their expenditure on repairs and maintenance of works. The amount of the item was £10,453, or £3400 more than in the previous year. Included in this sum was, practically speaking, the renovation of the largest gasholder; and in renovating it, they had improved it by putting in better material and strengthening it, and making it one-third larger. It was therefore good and useful expenditure. But the expense represented nearly one-half of the total outlay he had named; so that it more than covered the £3000 extra charged under the item of repairs and maintenance. He dwelt upon this as really it was the only particular in the accounts that was worth the attention of the shareholders. The profit was £1775 more than for the previous year; and this arose from the increased business. Regarding the sale of gas, they had an increase of £1302 in the total of £63,801. Extra gas sold meant extra profit made; and they had this in the balance of the account. The only disturbing feature in the account was the large amount spent upon purification. There was temporarily an increased expenditure in this connection, arising from a necessary expense on putting into operation some large purifiers, which more than doubled the Company's purifying area. These purifiers required a larger amount of purifying material; and the cost of this had to go into the present accounts. When they came to the repair, maintenance, and renewal of mains and services, it was found that the item was rather less; there had, in fact, been a saving of £2401. But this was necessarily an item in which there must be variation. He did not personally rejoice over making a saving on wear and tear. He liked to have his dividend accompanied by a good expenditure on wear and tear, both on the works and in the district. He did not think there was any other figure of importance with which he need deal, excepting the one of general charges. This was up by £491. The Board had been giving the workmen some extra food allowance, and things of that sort, which had become necessary. Food was dearer all over the world; and he was sure the shareholders would concur in the wisdom of this action. In the course of the year, the Company suffered somewhat through the loss of a ship. Some meters, stoves, and things of that kind were lost; and this had reduced their insurance fund by £1120. When, however, he told the shareholders they had had the insurance fund untouched by a similar accident for about thirty years, he did not think they need be afraid of another accident coming. At the same time, the Board would take steps to replace the sum in future years. Growing out of the more technical part of the business, he should like to say that the whole of the internal management of the Company in Bombay was absolutely first-rate. The carbonizing returns per ton of coal were large, and had excited the admiration of the Directors, and especially of Mr. Penny. The shareholders must realize how different was the situation in Bombay from what it was over here, and therefore how much greater was the credit to be given to the officers. He hoped the shareholders would recognize this before the meeting ended. There was a photograph in the room of half-a-dozen devoted Englishmen surrounded by native servants. Although the wages account might not look very heavy, it included a myriad of native workmen, among whom these half-dozen Englishmen worked; and they succeeded in giving the Company the best results. They had lately been showing high-pressure lighting; and a circular had been distributed throughout Bombay showing what a good effect high-pressure lighting had had in South London.* This went to show that the management in Bombay was thoroughly up-to-date. They lost no opportunity of pushing the business. But their task was not a light one. Bombay was an enormous place. It used to be the second city of the Empire; and to-day it was fourth or fifth. It was not a great gas-lighting city, nor was the population a great gas-using one. Their mains extended over a peninsula 9 miles long; and the area was very little less than that of the Gaslight and Coke Company. On the large mileage of mains, they had a slender gas consumption. It only amounted to considerably less than 2 million cubic feet per mile per annum; whereas in London it was 7½ millions and in some cases nearly 10 millions, and, in the suburbs of London and in the cities of England, it ran to 5 or 6 millions. Therefore, the shareholders would see how extended and scattered were the people supplied with gas, and how hard it must be to get custom and, when they did get it, how poorly it compared with what they were accustomed to in England, where they had dense consumption in the more profitable portions of the supply areas. This showed, as he said, that their officers had a considerable task, and one that they discharged with the utmost efficiency, in the best spirit, and with a zeal, rectitude, and earnestness which was beyond all praise, and which in certain previous times in the Company's history they had not enjoyed. Not long ago he had to tell the shareholders a melancholy tale; and now, when they had a comparatively different state of things with such efficiency, he felt he could not say enough. He then moved the adoption of the report and accounts, and the declaration of a dividend of 4½ per cent. (less income-tax), making 7½ per cent. for the year.

The DEPUTY-CHAIRMAN (Mr. W. G. Bradshaw) seconded the motion; and it was unanimously carried.

The DEPUTY-CHAIRMAN moved the re-election to their seats at the Board of Mr. H. E. Jones and Mr. Charles Hunt. He remarked that both gentlemen occupied positions in the front rank of their profession; and any gas company in the world would be fortunate in having them upon the Board.

Mr. LOUIS PENNY seconded the motion; and it was cordially passed.

Both the CHAIRMAN and Mr. HUNT acknowledged their re-election.

Proposed by Mr. SAMUEL SPENCER, and seconded by Mr. H. F. HILLS, the retiring Auditors (Mr. Spencer Gore Browne and Mr. Ernest W. Drew, F.C.A.) were reappointed.

* This circular was a reprint of the article in the "JOURNAL," on "The Lights o' South London," Jan. 21 last, p. 165.

The CHAIRMAN moved a vote of thanks to their officers and native staff in Bombay. They were all good workers and faithful servants; and he asked the shareholders to express their contentment with, and appreciation of, their operations.

Mr. W. RICHARDS remarked that the shareholders felt they were splendidly served, and they were glad of this opportunity of expressing their satisfaction. He had pleasure in seconding the motion.

The DEPUTY-CHAIRMAN remarked that in case these remarks were sent to Bombay, and in order to prevent the officers thinking the Board were not unanimous on the point, he might say that the Directors all most heartily concurred in everything that had been said as to the good work done. The Company were very fortunate in the gentlemen representing them in Bombay.

The CHAIRMAN remarked that he was sure Mr. Burch, and his efficient Assistant (Mr. Lane), together with Mr. Woodford, the accountant, and others, as well as the native staff, would be highly gratified with what had been stated. The members of their distribution staff were carrying on excellent operations; and the Board were at the present time considering the question of a new show-room in another part of the city. Everything, in fact, in Bombay was being pushed in the best possible manner.

Mr. F. R. SMITH suggested the inclusion in the resolution of Mr. Dickson and the London staff; and the CHAIRMAN expressed regret for his oversight, and spoke highly of the work of the Secretary and London staff.

The motion was heartily passed.

Mr. DICKSON, in acknowledging the vote on behalf of his fellow officers in Bombay and himself, together with their respective staffs, remarked that the past year had been one of considerable activity. Among other things, they had sent out about 6 miles of mains, weighing about 700 tons, 1500 meters, and the manager had had a turnover in the fittings account of something above £10,000.

Mr. SAMUEL SPENCER moved a vote of thanks to the Chairman and Directors for their conduct of the Company's affairs during the year. The balance-sheet they had presented was an extremely satisfactory one.

Mr. ERNEST W. DREW seconded the motion, which was cordially carried.

A few words of acknowledgment by the CHAIRMAN, on behalf of his colleagues and himself, concluded the proceedings.

ELECTRICITY v. GAS AT CARLISLE.

Loss of Large Gas Consumers.

A few weeks ago, the Electricity Engineer of the Carlisle Corporation was requested by his Committee to report in detail as to the provision of additional plant to meet applications for supplies of current; one being from Messrs. Robinson Bros., for whose supply a new feeder was to be laid, at an estimated cost of £600. He complied with the request; and the result was the passing by the Committee of a resolution adopting his recommendations, and asking the Town Clerk to apply to the Local Government Board for sanction to the borrowing of £7500, the estimated cost of the works. At the meeting of the City Council last Tuesday, the resolution came up for confirmation.

Mr. GIBBINGS explained that the Committee had received an application from Messrs. Robinson Bros., and had also had under consideration one from Messrs. Hudson Scott and Sons, with whom an arrangement had been made for a supply of electricity. This would enormously increase the output of current, and involve a considerable extension of plant. The Committee expected a revenue from these two sources of between £1500 and £2000 a year; and it would involve an expenditure of £7500 on additional plant. The matter came before the Council as the unanimous recommendation of the Committee.

Mr. J. P. BUCK (the Chairman of the Gas Committee) adverted to the policy which he said the Electricity Committee were pursuing, as shown by the arrangement made in respect of Messrs. Robinson Bros., and he observed that if the policy of the Committee was going to be pursued, they, as a Council, were in for a little trouble in the city. In order to put himself in order, he would move as an amendment that the minute relating to Messrs. Robinson Bros. be referred back for further consideration. The firm had been very large consumers of gas for many years, and they had applied for a reduction in the price. The Gas Committee had not seen their way to make any variation in the price for one man or another. This was the principle that was laid down—that every man or woman who bought gas should pay a certain price for it. Following that principle, the Committee had lost this very excellent customer; and if they considered that the firm had been using between 2 and 3 million cubic feet of gas per annum, they would see that this loss would considerably reduce their revenue in regard to turnover from gas, and increase the cost of the undertaking in proportion. If this policy was to be continued, the probability was that they would not be in a position to reduce the price of gas to anyone. The Gas Committee were at present in negotiation with the London and North-Western Railway Company on the question of a reduction in the price of gas. They had been told times out of number that it was not desirable to reduce the price, because if they did it would affect the sum paid towards the reduction of the rates. But he could not see why the people who consumed gas should be expected to pay towards the rates over and above what they paid for the gas. If they had undertaken any liabilities with regard to their city, let them all pay their way, and not let the gas consumers pay something like 30 or 40 per cent. more than they needed to do for gas. He thought the time had now arrived when some stronger position would have to be taken up that the gas supplied to the citizens should be reduced in price, not to a small but to a considerable extent; and if the working men had to be mulcted for the sake of the rich men, it was time that someone should take a stand in the matter. He had not the slightest objection to the Electricity Committee offering their current at the very lowest price; and he was not

one who expected large profits from these undertakings. But that people who consumed either gas or electricity should be expected to pay high prices for them was beyond his comprehension. Especially was this the case with gas. And why should a consumer of gas of the capacity of Messrs. Robinson Bros. be removed simply because they had laid it down that the price should be kept at the same level for all? If the Gas Committee had been able to offer the firm gas at 1s. 6d. to 1s. 9d. per 1000 cubic feet, he was sure the Council would not have been asked to take the step now proposed. Further, he thought the price asked for electricity from both Messrs. Robinson Bros. and Messrs. Hudson Scott and Sons was extremely low. While everybody was asked to pay the same price for gas, this was not the case in regard to electricity; and the working man was mulcted by having to pay a large price for gas in order that rich people might have electricity very cheap.

Mr. CAMPBELL seconded the amendment. He said he did so because he thought that at the present time it was desirable that the Council as a whole should consider this question of competition between the Electricity and the Gas Departments. They had two departments quoting a price—they had one department which was, in a sense, free to quote, and the other was not free. The Gas Department was the goose that laid the golden eggs so far as the City Fund was concerned.

After a long discussion,

The MAYOR (Mr. S. C. Ferguson) remarked that the Gas Committee must be impressed with what had been said as to the price of gas.

Mr. THOMLINSON said he thought it was unfair that the Electricity Committee should make prices to suit themselves and that the Gas Committee should be tied down to their price.

The MAYOR: The Gas Committee have tied themselves; but we shall consider that.

Mr. GIBBINGS said he should like to state, on behalf of the Electricity Committee, that there was absolutely no unfair rivalry or competition between them and the Gas Committee. That there was competition, and bound to be competition, he admitted. The same thing applied to Messrs. Robinson Bros. as applied to Messrs. Hudson Scott and Sons; and he believed if the Electricity Committee had not been asked to supply current the Gas Committee would not have been asked to supply gas, as the parties concerned would have provided plant of their own.

The amendment was then withdrawn, and the minutes of the Electricity Committee were confirmed.

Limavady Gas Undertaking.—The Limavady Urban District Council have adopted the recommendations of the Lighting Committee for changes in the administration of the gas undertaking, including an increase in the price of gas; the object being to obviate financial difficulties, and, by the discharge of a Board of Works loan, enable the gas undertaking to accrue to the ratepayers as one of their most valuable assets.

OPPOSITION TO IRISH ELECTRIC LIGHT ORDERS.

Inquiries on behalf of the Board of Trade have lately been held in regard to applications made by Irish Urban District Councils for Provisional Orders for electric lighting.

Banbridge.

The inquiry in respect of this town was conducted by Mr. G. B. DEANE; and in the course of it the following evidence was given.

Mr. JOHN MURPHY, J.P., the Chairman of the District Council, said he was a shareholder in the Gas Company, and was in favour of the scheme of electric lighting. He supported and voted for it, and would be a customer for the electric light when installed. The question had been before the Council and had been discussed during the past five years. There had been numerous complaints regarding the public lighting of the town, and also from residents as to the light in their private houses. The price of gas was 4s. 7d. per 1000 cubic feet. He saw no way of reasonably improving the public lighting of the town except by electric lighting; and a considerable number of the people were in favour of this. The only opposition, he believed came from the Gas Company's shareholders and those connected in some way with the Company, and from timid people who had been influenced by misleading statements as to the costs it would mean to the rates.

Cross-examined by Mr. HENRY HANNA, K.C., who appeared for the Gas Company, witness admitted that when a vacancy arose for a Director of the Gas Company he had conversed with some of those concerned as to being elected to the position, and another gentleman was chosen instead. He had spoken against the electric lighting scheme at the Council previous to this, and did not do so afterwards. He might have been influenced partly by that fact in supporting the scheme now, as well as for the other reasons.

More evidence having been given in support of the application,

Mr. HANNA, in opening the opposition case, pointed out that any unsatisfactory lighting of the public lamps of the town was due to the lamps being placed so far apart, combined with the fact that the main streets of the town were broader than in any other town. Owing to the unsatisfactory nature of the standards, which were the property of the Council, it was impossible to keep incandescent mantles on the burners; and it was found necessary to revert to the open-flame burner, which did not give so brilliant a light as the mantle.

Mr. *Alexander M'Neight*, the Secretary of the Company, said he had never had a complaint from the Council or the consumers generally as to the quality or pressure of the gas. The only complaints he received were as to irregularity in the hours of lighting and as to escapes from time to time; and these were immediately investigated and attended to. In 1911 the Company went to a very considerable outlay for new machinery, a new gas-engine, hydraulic main, and retorts, at a cost of more than £1000. Continual alterations and improvements had been made as they were found necessary.

Mr. *James M'Ilroy*, J.P., a member of the Council, said he was

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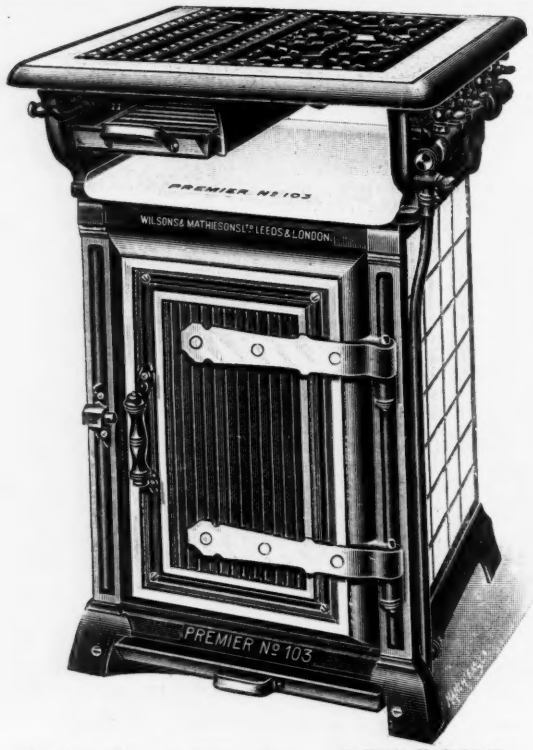

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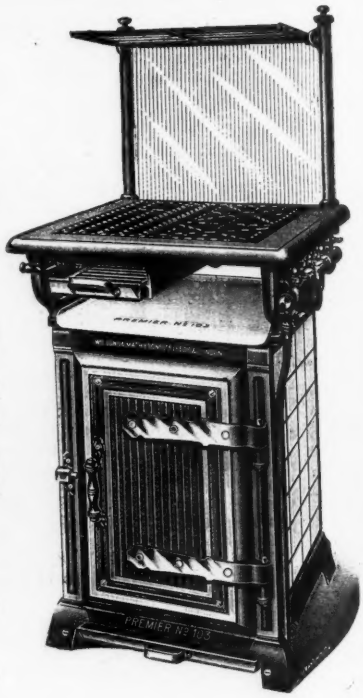

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Chairman of the Gas Company, and had been a shareholder for some years. Apart from two occasions, he had never heard complaints as to the private lighting in the town. There was never a complaint made to the Company that was not attended to at once. The Company were quite willing to light the town properly by incandescent lighting if the Council put up proper standards and lamps. From his knowledge of the town and district there was no general demand for electric light.

Mr. *T. E. Pye* gave evidence in support of the contention that gas was preferable in many respects to electricity, particularly as regards the cost.

Other evidence having been given against the scheme, the inquiry was adjourned until yesterday.

Portrush.

At an inquiry held at Portrush into an application by the Urban District Council for an Electric Light Provisional Order, Mr. Murphy, B.L., for ratepayers who are Directors of the Gas Company, and for Miss S. Wallace, another ratepayer, opposed, on the ground that the scheme would add to the rates without any corresponding advantage; and he contended that, in the matter of gas lighting, Portrush would bear favourable comparison with other towns in Ireland. Miss Wallace said she had always found the system of gas lighting satisfactory; and she added that she "would never dream of taking out the existing gas-fittings" from the property in which she was interested, as she did not think the electric light would make her houses more attractive. Mr. T. Tomlinson said the people of the town would, in his opinion, be slow to avail themselves of the electric light. Mr. J. W. M'Lusky, the Manager of the gas-works, attributed to defective fittings any complaints that had been made about the gas supply. Referring to a statement made by the Electricity Engineer as to the illuminating power given by high-pressure gas-lamps, he said the figures must have been based upon the Manchester tests, which, so far as high-pressure gas was concerned, were altogether unreliable. Witness explained the tests, and the Inspector said he would investigate the matter himself.

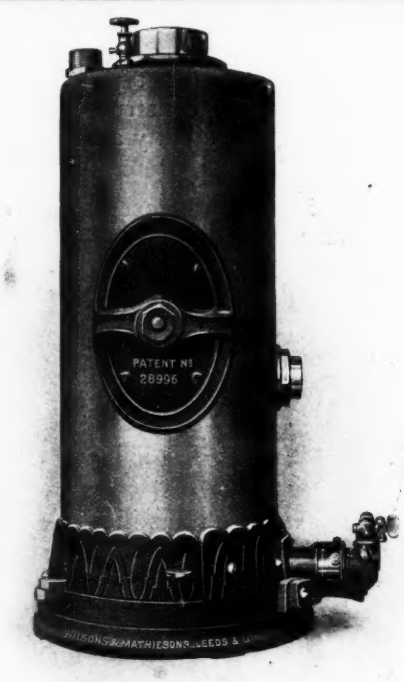
NOTTINGHAM AND THE DERWENT WATER SUPPLY.

[From a Local Correspondent.]

Although Nottingham ratepayers have long since had their eyes opened to the fact that their participation in the scheme which has had for its effect the impounding of the head waters of the Derwent is in the nature of an expensive luxury that might very well have been dispensed with, new circumstances have recently arisen which aggravate the unpleasantness of the situation. From the point of view of Corporation strategy, Nottingham could not be very well left without a share of the spoils, when the fight for access to the Derbyshire river was proceeding before the Parliamentary Committee at Westminster. Leicester's claims as the largest partner in the project were accentuated by the pressing nature of its demands; a water famine in the Metropolis of the Boot and Shoe Industry having been brought within measurable distance of realization. The demands of Sheffield and Derby were equally incontestable; and Derbyshire county authorities' rights having been adequately safeguarded, Nottingham's case to be included in the picture was looked upon as unanswerable. However, had those responsible for the administration of affairs in the Lace City known as much as they do now about the then unexplored resources lying closer to their own doors, they would have hesitated before they embarked upon expenditure which, for a long time, will saddle the city with a burden that, in the face of its present heavy municipal indebtedness, it can ill-afford to bear.

Disagreeable to a corporation, as to a private individual, to have to pay for something which later experience proves might have been dispensed with, the uncongenial nature of the operation was added to in Nottingham's case by the reflection that the character of the article itself is scarcely such—at present at any rate—as to commend it to general acceptance. It may be that chemical analysis affords irrefutable proof of purity; but the colour of the water (resembling the tint of *crême de menthe*, but *minus* the fragrant qualities of that appetizing compound) is scarcely such at present as to commend itself to inhabitants of the part of Nottingham which has been scheduled for the doubtful privilege of receiving the first supply. The Derbyshire water has been turned on to the Mapperley district—an elevated area embracing some of the best residential property in the town; and the result is not entirely to the liking of the consumers. Grumbling about the matter has been going on for some time in the columns of the Press, and the complaint found pointed expression at the meeting of the Council on Monday of last week. Mr. A. R. Atkey, the Chairman of the Water Committee, who succeeded Sir Edmund Frazer as one of Nottingham's representatives upon the Derwent Valley Water Board, attempted to make light of the matter; but he was not entirely successful in allaying misgivings. Mr. J. T. Spalding, an ex-Mayor, asked for an explanation of the cause of the discolouration. He enquired also whether the water was pure and suitable for domestic consumption; why the ratepayers in the Mapperley district were selected as the recipients; and if there would be a reduction in the rate owing to this differential treatment. Mr. Atkey's jocoseness found expression in the observation that Mr. Spalding had discovered "the secret." It was the Derwent Valley water that was being supplied. The cause of the discolouration, he added with more seriousness, was somewhat difficult to explain, and it would require expert technical knowledge to understand it fully. Roughly speaking, it might be described as being due to the fact that the water came off a peaty soil, which, however, added materially to its advantage from the point of view of consumption. The water was of great purity—a fact which could be proved, by all kinds of analyses, to the satisfaction of all kinds of people whose curiosity had been excited by this "wonderful water" during the few preceding months. The water was suitable in every respect for domestic consumption, and especially

HOT WATER AT ALL TIMES.



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for washing. Mr. Spalding had asked why the ratepayers in this particular area had been selected for the privilege of first receiving the most expensive water which Nottingham had ever been favoured with. The reply was that it was more advantageous to give the water to Mapperley because the economy was greater. On the point whether a substantial reduction could be expected in the rate, it seemed paradoxical that the people getting the most highly-priced and valuable commodity should seek a reduction by virtue of that circumstance; and he regretted that this afforded another lamentable example of how people failed to appreciate "rare and refreshing fruit" when they got it. Mr. Spalding assured Mr. Atkey that the inhabitants did not appreciate the water; and the ex-Mayor's mild observation embodies but a reflex of the feeling which is daily becoming more apparent; many complaints being publicly forthcoming. not only as to the doubtful colour, but the offensive odour of the water. If he is so enamoured of its quality, Mr. Atkey is advised to try it in the district in which he lives, and leave the residents of Mapperley to their old resources. Seriously, the demand is also now being put forward for an independent Government analysis of the water, which may be good enough, as Mr. Atkey whimsically suggests, for washing purposes, but which scarcely comes up to the potable standard.

ADDITIONAL RESERVOIRS FOR SHEFFIELD.

At the Meeting of the Sheffield Corporation last Wednesday, the minutes presented by the Water Committee contained a recommendation that the Council should at once proceed with the construction of the Broomhead reservoir as the first instalment of the Ewden Valley water scheme.

Alderman Styring, the Chairman of the Committee, in presenting the minutes, said Sheffield's total resources at the present time were a little more than 18 million gallons per day; and it was calculated that from 1916 up to the time when they could complete the construction of any works the Council might authorize to be proceeded with, there would possibly be a deficiency of water. During the later years of the period of construction, they would, no doubt, have to arrange for temporary supplies, though it was quite possible, judging from previous experience, that they might go over the whole period without having to make any arrangement of the sort. The suggestion of the Water Committee was that the Corporation should commence at once with the construction of one of the reservoirs in the Ewden Valley, and that when this was partly completed—say in a period of four or five years—they should start the second reservoir. The Council would know that the Ewden Valley lay about half way between the Bradfield Valley and the valley of the Little Don, in which the Corporation's last water-works extensions were carried out. The land necessary for the construction of these reservoirs was purchased as far back as 1867. The Sheffield Water Company obtained powers to construct reservoirs in the Ewden Valley, and they then proceeded to purchase the land necessary for the purpose. Ever since the works were transferred to the Corporation in 1887, this land had been in the Corporation's possession unutilized. He thought that when it was realized that the Corporation had a supply which would only suffice for the needs of the city up to the year 1916, it would generally be agreed that it was quite time they set about providing some additional source of supply. Though there were statutory powers authorizing the Corporation to construct works, they had no power to borrow the money necessary for the purpose until the passing of their Bill of last session. The question arose as to how the proposed works were to be carried out. He thought everyone would agree that it was of the utmost importance that the Corporation should have works of perfectly unquestionable character so far as their stability was concerned. As the result of recent inquiries of all the large corporations who had undertaken works of this kind, the Committee had come to the conclusion that the best plan was to recommend the Council to proceed to construct these works by way of administration. If they decided in favour of this, he would like to point out that they must certainly expect that the officers of their staff, on whom the weight of the responsibility would fall, would have to receive some consideration in the way of extra remuneration.

The minutes were passed.

THREATENED FURTHER INCREASE IN GAS COAL PRICES.

The "Iron and Coal Trades Review" for last Friday contained the following editorial article under the heading of "Gas Coal Contracts."

It will be remembered that when contracts for gas coal, many of which are arranged for twelve months, to expire on June 30, were negotiated last year, collieries very justly insisted on advances of 2s. 6d. per ton upon previous prices, though 2s. was accepted in some cases. These advances were largely to cover the increased cost of production brought about by the various legislative measures that had become law. Besides this, however, provision had to be made for any increases in the wages of miners, who have recently received two advances of 5 per cent.; and if they obtain another 5 per cent., for which application has now been made, it will bring their percentage up to the maximum. The time is now rapidly approaching when many gas concerns will be in the market again; and though it is full early in the season, there are a number of inquiries in circulation. The London companies are already reported to have paid an advance of from 1s. 9d. to 2s. on last prices for Durham qualities; and in regard to other renewals, it is understood that an endeavour will be made to bring prices up to a level 3s. 6d. per ton higher than that of two years ago. That is to say, that where contracts were renewed at advances of 2s. 6d. per ton last year, another 1s. per ton will be quoted; but in cases where

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only 2s. per ton advance was obtained last year, 1s. 6d. per ton advance will be asked.

Obviously, collieries are fully justified in insisting upon good prices for gas coal. Gas is used more extensively than ever for cooking and heating, besides which gas-engines for power purposes are increasing in number, especially at the smaller works. This, of course, means competition with house coals and manufacturing fuels; and when it is remembered that some years ago house coal contract prices were relatively much lower than those for gas coal, allowing for the difference in the size of screens, it will readily be admitted that gas concerns were then on exceptionally favoured terms, and that a readjustment was very necessary. It should also be remembered that, in spite of the economies in the use of coal for gas making effected by oil and water-gas plants, the total requirements of coal for gas making are increasing yearly, while production—at any rate during the last few years—of suitable coals has been much the same; and though many works use a larger proportion of nuts and slacks than formerly, this does not materially affect the position.

The higher prices obtained during 1912 applied mainly to the latter half of the year only, though in some instances fancy figures were paid for supplies during the strike peiod; and that gas concerns can well afford an additional advance is shown by the profits made by them, which compare favourably with those of previous years, notwithstanding heavy advertising expenses, and in many instances reductions in the price of gas. Of course, the principal revenue has been obtained from the bye-products, the advance in the price of which has more than equalled the extra cost of coal, especially where the manufacture of sulphate of ammonia is carried on. It may be pointed out, in conclusion, that stocks at gas-works are, generally speaking, lower than usual, as they have not had a favourable opportunity to replenish them since the strike: and no doubt this fact will go a long way in helping collieries to obtain the further advances.

Tullamore Gas Supply.—At the last meeting of the Tullamore Urban District Council, a letter was read from Mr. J. A. Lumley, the Secretary of the Gas Company (who is also Chairman of the Council) offering to negotiate with them for the purchase of the gas-works. The Council, however, declined to do so, and decided to offer the Company 3s. 6d. per 1000 cubic feet as the price of gas, instead of the 5s. 10d. now charged.

Kimberley Water-Works Company, Limited.—The Directors of the Company, in their report for the past year, state that the working account shows a balance of £28,175; making, with interest on investments, a total profit of £30,456. The sum of £568 has been provided for the usual items of depreciation, and £1600 for interest on the debenture stock. The Directors propose to write-off £7283 from construction and £1881 from the book value of investments, and to pay a dividend of 2½ per cent. for the six months to Dec. 31, making 5 per cent. for the year. They further recommend the payment of a bonus of 1s. 6d. per share—bringing up the total distribution to 8s. 6d.

NOTES FROM SCOTLAND.

From Our Own Correspondents.

Saturday.

The annual general meeting of the Western Section of the Scottish Junior Gas Association was held at the Technical College on Saturday; and the proceedings were made both interesting and instructive by a lecture delivered by Mr. Napier, of Alloa, upon the joint administration of the gas and the electricity departments of a corporation. There is no doubt that there are many points in favour of the single control, especially in towns of the size of Alloa. One is reminded of the town of Cowdenbeath, where there are three lighting authorities—the Gas Company, the Electric Light Company, and the Corporation—who make and supply their own street lamps with electric light. Surely here is an instance where the whole could be under one head, with saving to the community and advantage to the different bodies at present supplying the district. The prevention of competition in a town of medium-size is a great saving of money, especially when the same object is in view by the competitors. The joint collection of the gas and electricity accounts must make for economy, in the same way as is being found in connection with the water-rates in Edinburgh. The question of the loss by the storage of electricity cannot be too often brought before the public, as it is so very much greater than when the substance stored is coal gas. Mr. Napier said it paid him to sell electricity at ½d. per unit; but it would be interesting to hear how he calculates this, as, by his own showing, it costs him 0·72d. per unit, without interest and standing charges. It is true that a day load at anything above the actual cost of production helps to reduce the standing charges; but the fuel, water, stores, and repairs during the summer period come to 0·375d., and there must be some cost for collection and distribution. It would have been interesting to have heard Mr. Napier's troubles in the washing of the producer gas, as this has been the difficulty with all the plants when coke has been the fuel. If Mr. Napier has solved it, he has helped to improve the position of the coke market and to reduce the cost of power.

Edinburgh.—The Edinburgh and District Water Trust accepted the tender of Mr. R. H. Watson, contractor, for the additional filter at Swanston, at a price of £1150 os. 11d.; this being the lowest estimate received. The total receipts under the joint collection of rates has equalled 95·54 per cent., as against 95·14 per cent. last year. It was reported that the joint collection has evidently proved satisfactory; and the ratepayers have expressed their appreciation of such a businesslike system. The water-works have been valued by the Assessors of Railways and Canals (Scotland) for the year ending Whitsunday, 1914, at £142,272; and this figure has been accepted by the Treasurer.

Glasgow.—Mr. Fred S. Grogan, of the British Electric Transformer Company, Limited, of London, has been lecturing on the use of electricity for heating and cooking. He has been urging the usual claim of

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WORKS: Gothic Works, EDMONTON, N.; Gothic Ironworks, FALKIRK; and Gothic Works, BIRMINGHAM.

SHOW-ROOMS AND BRANCHES: 25, Princes Street, Oxford Circus, W.; 136, Renfield Street, GLASGOW; 56, Broad Street, BIRMINGHAM; 83, Old Market Street, BRISTOL; 13, Whitworth Street West, MANCHESTER; 8, Exchange Place, Donegall Street, BELFAST; 333, Queen Street, MELBOURNE; and 12, Cunningham Lane, Pitt Street, SYDNEY, N.S.W.

the electricians—that by electric cooking a 4-lb. joint was equivalent to a 5½-lb. joint cooked in an ordinary oven, and claimed that there was a waste of about a quarter to one-third in cooking by coal or gas, as against a loss of only about one-tenth with electric cooking. It is a pity that the Corporation Gas Department were not allowed to place their gas-cookers alongside the "Tricity" appliance, when this claim would have been at once proved false. It is to be hoped that the poorer folk, to whom the electric cooker was claimed to be adapted as well as for well-to-do people, will not have arranged for an installation of this apparatus, or they will be wofully disappointed. However, the very large cost of the apparatus in the first instance will probably deter them from fixing these cookers.

At a meeting of the Dalmarnock Ward Committee, it was agreed to make a representation with a view to having the public streets of the ward adequately lighted by electricity. It might be suggested that the ward representatives should pay a visit to Bath Street, and see what can be done in the way of lighting streets by the older illuminant, coal gas, when they will probably not be so ready to consider that there is only one light for street illumination, and that electric. Perhaps Mr. Wilson could arrange for such a visit for all the members of the various district wards.

The annual inspection of the Glasgow Water-Works has been provisionally fixed for June 26 and 27, when the company will travel by rail to Kingshouse and then drive to Loch Voil and Loch Doine, to see the territory which it has been decided to include in the extension of the water undertaking. The return will be made to Callander in the afternoon, and thence by coach to the Trossachs Hotel, where the night will be spent. Next morning, Loch Katrine will be inspected down to Stronachlachar, and the new inlet works from Loch Arklet seen. The inspection will be continued down the side of Loch Chon by way of Kinlochard to Couligarten, then to Aberfoyle, by way of Duchray Castle and valley, and at Aberfoyle the train for Glasgow will be taken.

Aberdeen.—The recommendation of the Gas Committee regarding the increase in the salary of Mr. Samuel Milne, the Gas Engineer, and the Assistant, Mr. Charles E. Smith, was agreed to by the Town Council at their meeting.

Buckhaven.—The Council on Monday considered the question of the municipal gas-works, it having been reported by the Gas Committee that they had had a report from Mr. Henry O'Connor and an opinion of Counsel upon certain points. They had discussed this and other matters with Mr. O'Connor; and they recommended to the Council that it would be judicious to have a meeting with the Directors of the two Gas Companies. Councillor Simpson said that the point the Committee wished to find out was what terms the Companies were likely to want for their works. It would be detrimental to the whole scheme if all the details were made public now. After some discussion, power to have the interview was granted to the Committee.

Carnoustie.—It was remitted to the Gas Committee to consider the motion of Councillor Hogg, "that in future the Gas Department provide and lay all gas-services to street-lamps, and that the cost thereof be borne by said department." Considerable discussion took place, as there was doubt as to how the matter was affected by the Gas Act.

Kirkcaldy.—Although it was decided at the Town Council meeting last month that there should be a plebiscite upon the proposed gas-works extension, no step has yet been taken to obtain the opinion of the ratepayers. At the meeting of the Council on Monday night, instructions will be asked as to the manner in which the plebiscite is to be taken; and it is very possible that the consideration of this point may lead to the whole question being opened up, as there seems considerable diversity of opinion among those who supported the motion for the plebiscite—some having very little sympathy with this method of deciding the question, although in favour of delay. Why do not the councillors who desire this delay take another opinion upon the necessity of incurring the large expenditure proposed? Mr. Macpherson declared the works were capable for several years to come. If so, surely only a small expenditure would suffice to make them able to supply all the gas required.

Motherwell.—A special meeting of the Town Council was held, when it was reported that the resolution adopting the Burghs Gas Supply (Scotland) Act of 1876 had been registered in the Sheriff Court books at Hamilton, and was therefore now in force in the burgh. The Committee who had had the matter under consideration sent forward a unanimous recommendation that the Town Council should acquire the Motherwell Gas-Works, and that for this purpose notice be given to the Gas Company that the Council are willing to buy or treat for the purchase of the undertaking on terms mutually agreed upon, or to be fixed by arbitration in the manner provided by the Lands Clauses Consolidation (Scotland) Act of 1845. The Committee's recommendation was approved by the Council, who instructed the Clerk to serve such a notice on the Company. The capital of the Company is £60,000, £57,307 of which is paid up.

An elm tree, more than 200 years old, which has been cut down in the Chestnut Avenue in Bushey Park, Hampton Court, was found, according to the "Daily Mail," to have the iron framework of an old-fashioned street-lamp embedded in it.

The Town Council of Elie, Fife, have decided to renew all the street gas-lanterns, by installing Messrs. Alder and Mackay's hurricane proof copper lanterns, and fitting them with the "A. & M." patent automatic street-lighting controller. The Darlington Corporation have also decided to instal an additional 300 of the "A. & M." controllers.

The South Hants Water Company have agreed to pay £13,000 for the undertaking of the Bishop's Waltham Water Company, in addition to all the parliamentary charges incurred for the Provisional Order. The shareholders of the latter Company will receive an addition to the value of their shares, and the annual dividends will be increased.

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CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *April* 12.

Sulphate of Ammonia.

During the past week the lack of strength in the position of this material has become more pronounced, and it has only been found possible to effect further sales by making some concession in prices. The exports from the United Kingdom in March this year to Spain, Java, Japan, and the United States all show a considerable decrease, as compared with March, 1912, and this fact has, of course, not tended to improve the situation. The nearest values at the close are £13 16s. 3d. per ton f.o.b. Hull, £13 17s. 6d. per ton f.o.b. Liverpool, and £14 per ton f.o.b. Leith. Producers have shown rather more inclination to contract for future delivery, but for the most part they are still asking higher figures than it is possible to realize.

Nitrate of Soda.

The market for this article is somewhat easier, and spot quotations have been reduced to 11s. 10½d. per cwt. for ordinary quality and 12s. for refined.

LONDON, *April* 14.

Tar Products.

The markets for tar products are decidedly quiet, and business is difficult to arrange at the present moment. Pitch has weakened slightly during the past week, which possibly is due to several causes. Ninety per cent. benzol is still firm, and the inquiry is good for both prompt and forward delivery. Solvent naphtha is quiet, and there is no alteration in price. Heavy naphtha is in fair demand; but the quotation does not alter. There has been a further weakening in crude carbolic, and business is reported to have been done several times at 1s. 6d. per gallon f.o.b. English ports. Creosote still remains very firm.

The average values during the week were: Tar, 30s. to 34s. Pitch, London, 48s. to 48s. 6d.; east coast, 47s. 6d. to 48s.; west coast, Clyde, 47s. 6d. to 48s.; Manchester, 47s. to 48s.; Liverpool, 47s. 6d. to 48s. 6d. Benzol, 90 per cent., naked, London, 11½d. to 1s.; North, 11d. to 11½d.; 50-90 per cent., naked, London, 10d. to 10½d.; North, 10d. Toluol, naked, London, 10½d. to 11d.; North, 10d. to 10½d. Crude naphtha, in bulk, London, 5½d. to 5⅝d.; North, 5d. to 5½d. Solvent naphtha, naked, London, 1s. 0½d. to 1s. 1d.; North, 1s. to 1s. 0½d. f.o.b. Heavy naphtha, naked, London, 11½d. to 1s. f.o.b.; North, 10d. to 10½d. f.o.b. Creosote, in bulk, London, 3½d. to 3⅝d.; North, 3½d. to 3¼d. Heavy oils, in bulk, 3½d. to 3⅝d. Carbolic acid, casks included, 60 per cent., prompt, east and west coasts, 1s. 6d. to 1s. 6½d. Naphthalene, £5 to £9; salts, 50s. to 55s., bags included. Anthracene, "A" quality, 1½d. to 1⅝d. per unit, packages included and delivered.

Sulphate of Ammonia.

This market is very quiet, and tender parcels have gone at reduced prices during the past week, while further reductions are expected. Orders from abroad are still scarce. Outside London makes to-day are not worth more than £13 3s. 9d. At Leith the quotation is £13 18s. 9d. to £14; Hull, £13 16s. 3d.; Liverpool, £13 16s. 3d. to £13 17s. 6d.; Middlesbrough, £13 16s. 3d.

COAL TRADE REPORTS.

Northern Coal Trade.

There is a strong demand for coals, and the prices continue firm, though the shipments are not so brisk as is sometimes the case at this season. In steam coals, there have been sales at varied prices—from 16s. 3d. to 17s. per ton f.o.b. for best Northumbrians. Second-class steams are from 15s.; and steam smalls from 11s. to 12s. 6d. There appears to be a very small amount of coal free for sale for this month's shipment. In the gas coal trade, the demand is full; but there does not seem to be quite the scarcity noticed a week or so ago. Best Durhams are about 15s. 3d. to 15s. 6d. per ton f.o.b.; second-class gas coals are about 14s. 9d. to 15s.; and "Wear specials" from 15s. 6d. to 15s. 9d. The demand is strong for Durham coals for many purposes; and this influences the supply of gas coals available at present. There are some contracts in the market, both for home and foreign users of gas coals; but the high prices, and also the high sea freights, make settlements of these rather slow, and such as are concluded are at figures approaching those that are given above. The consumption of gas coal is at present higher than usual at this season. Gas coke is now being exported more freely; and the price is firmer. Good gas coke is about 17s. to 17s. 6d. per ton f.o.b. in the Tyne; but for prompt sales rather higher quotations are made.

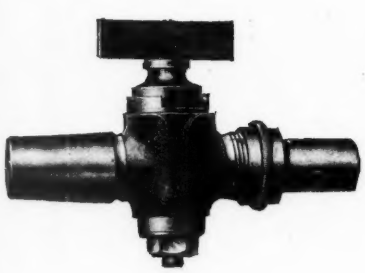
Scotch Coal Trade.

The reports from all over Scotland are to the effect that the coal trade is steady, and that all kinds of large coal are in demand. On Friday, the following were the approximate prices quoted on the Glasgow Coal Exchange: Steam coal, 13s. 6d. to 14s.; splint, 14s. 9d. to 15s. 3d.; ell, 13s. 6d. to 14s.; treble, 13s. 9d. to 14s. 3d.; doubles, 13s. 6d. to 14s.; and singles, 13s. 3d. to 13s. 9d.—f.o.b. Glasgow.

The Committee who have charge of the arrangements for the Fuel, Light, and Power Exhibition, to be held in Sheffield in the autumn, have issued a prospectus. The exhibition, which will remain open from Oct. 24 to Nov. 15, will be under the patronage of the Lord Mayor (Alderman S. Osborn), the Master Cutler (Mr. J. Rossiter Hoyle), and the President of the Chamber of Commerce (Mr. T. W. Ward). The Hon. Secretary is Councillor W. Bashforth, and there is a strong Advisory Committee. The exhibits will be divided into four sections—fuel, light, power, and general exhibits. All the newest smokeless fuels will be shown—the latest applications of electricity and acetylene, petrol gas, and air gas for lighting, and electricity, gas, and oil for power. Fans, ventilators, humidifiers, pyrometers, tintometers, and other similar appliances will also be exhibited.

BEST GUN-METAL MAIN TAPS

OBLONG GASWAY.



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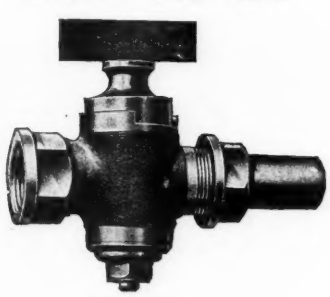
ROUND GASWAY.



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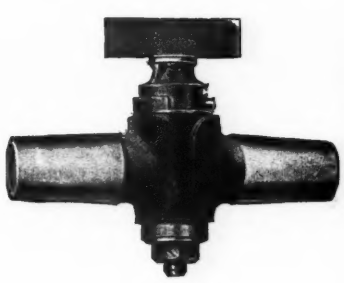
OBLONG GASWAY.



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PRICES ON APPLICATION. —
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Gas v. Electricity as Ventilating Agents.

There was an amusing incident at the closing lecture in connection with the Doncaster Health Week on Saturday last. Professor Vivian B. Lewes had been lecturing upon "Air and Smoke in their Relation to Health"; and discussion followed, in three-minute speeches. Those who spoke included Mr. E. S. Rayner, the Electricity Engineer to the Corporation, who said the principal function of his department was to diminish the smoke nuisance. Pointing to the electric light in the hall and an electric stove on the platform, he claimed that they were vastly superior to gas, and did not give off any fumes. Replying to the discussion, Professor Lewes said Mr. Rayner had "put his foot in it." He had told them he had a light which because it gave off no fumes was much more healthy than gas. He (Professor Lewes) spoke with considerable weight upon this question, because he had spent years in experimenting upon it. If they took a dwelling-room lighted by electricity and another lighted by gas, they would find that the air in the breathing space was infinitely purer in the latter than in the former. And why? Because electricity gave off nothing. When they were burning gas, it set up heat currents which caused movement of the air, and were the greatest factor for health, because gas burnt off and killed the germs in the air. It left the charred remains of those germs as a brown patch over the gas-burner, and so marked the work it had been doing. The Mayor (Mr. J. T. Kay), amid laughter, remarked that after this he predicted a serious conversation between the Chairman of the Electricity Committee (Councillor Stirling), who was in the chair, and Mr. Rayner; and he said he was sure the Gas Engineer (Mr. R. Watson, who was also present and spoke at the meeting) would be well satisfied with what he had heard. The incident caused much amusement.

Benefits of Cheap Gas.—In a letter recently addressed to local papers, Mr. Edwin Ransom, of Bedford, called attention to the benefits of cheap gas. His letter was prompted by the fact that on the 31st of March the price of gas at Luton was reduced from 1s. 11d. to 1s. 10d. per 1000 cubic feet. He pointed out that this penny to the consumer might be accompanied by one quarter per cent. to the shareholder, under the sliding-scale; and that, calculated on last year's sale of gas, it amounted to about £2030, while the quarter per cent. came to about £108. A divisible profit of £2138 therefore went to consumer and shareholder in the proportion of about 19 to 1. At Bedford, out of a sum of (say) £970 extra divisible profit, composed of the two items calculated as above, the consumer would claim about seven-eighths and the shareholder one-eighth. Towards the close of his letter, Mr. Ransom referred to the increasing use of gas for lighting purposes, even by the side of electricity; and he showed that with the best inverted mantle 166 cubic feet of gas (costing at 2s. 6d. per 1000 feet 5d., and at 1s. 10d. 3⅜d.) yield 10,000-candle power, while with the best new low-volt bulb, 10 units (costing at 6d. per unit 5s. and at 1d. per unit 10d.) yield the same candle power.

Skegness Gas Company Attacked.

Writing on the subject of the proceedings recently taken against the Skegness Gas Company to compel them to reduce their price, as reported in our "Legal Intelligence," a local correspondent writes: The storm which, figuratively speaking, has been long hovering around Skegness—a favourite resort on the Lincolnshire coast—threatening to aggravate the already strained relations between the local authorities and the Company responsible for the gas supply, has at length broken; and, although the result is not such that it can be regarded with any degree of satisfaction by the attacking party, it may be said to have temporarily cleared the air. The murmurings had been long and loud—allegations of inadequate illuminating power being coupled with a demand for a reduction in price. But the supposed delinquents instead of turning their cheek to the smiters, countered their opponents by the imposition of an increased charge. There had been much heated talk about the asserted rapaciousness of those entrusted with the statutory powers of supply, and the matter came to a head last Friday, when an application was made to the Court of Quarter Sessions for the Lindsey Division of the county, sitting at Lincoln, under the presidency of Mr. W. Embletons-Fox, the business of the Magistrates being to deal with a petition preferred by certain consumers resident at Skegness for the purpose of obtaining, if possible, a reduction in the rates imposed by the Gas Company. The importance attached to the issue was illustrated by the fact that King's Counsel had been briefed on either side. But, as shown by the report of the case, the result was a *fiasco;* and the petitioners were ordered to pay to the Company the costs incidental to the petition. Though the proceedings have been entirely favourable to the view which from the first was put forward by the Company, evidence is not wanting locally of the determination to take further action, which obviously can only have its logical sequel upon the basis of the acquisition of the undertaking.

Gas Exhibition at Woodbridge.—A gas exhibition has just been held at Woodbridge, which combined with the usual cookery demonstrations a novel display of gas appliances. Prominent features of the show were a bath-room, equipped with bath, lavatory basin, &c., which were supplied with hot water from a Davis "Gilled Circulator," or alternatively, from a "Perfecta" geyser. A model kitchen was fitted with gas-cooker and washing-boiler, and suitably furnished. Brockway Phillips fans showed the utility of gas for ventilation. The Manager of the Gas Company (Mr. W. Orme) delivered a lecture on the uses of coal gas, illustrated by experiments dealing with the principles of combustion, &c. In the course of it, he drew attention to the lighting of the hall by means of a six-light inverted burner pendant, which had been continuously used with self-lighting mantles since 1910, with complete success; also to a high-power low-pressure lamp actuated by the "Telephos" push. The bath-room, kitchen, &c., were lighted by self-lighting mantles. Mrs. Godfrey Sutcliffe gave a very attractive and popular course of cookery lecture demonstrations.

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P.S.

Mr. W. Terrey on the Value of Good Plumbing.

There was a large gathering at the Grand Hotel, Sheffield, last Tuesday evening, on the occasion of the annual dinner of the Sheffield Master Plumbers' Association. Among the company was Mr. William Terrey, the Manager of the Water Department of the Corporation; and to him was entrusted the toast of the evening—"The Sheffield Master Plumbers' Association." In proposing it, he said he regarded plumbing as the most important work done by any class of craftsmen, from the point of view of the welfare of the community, and it ought to be specialized. Defective work meant ill-health, disease, and death; and it probably involved needless waste of valuable water resources, and a constantly increasing expense to the community. There was a large amount of cheap and "jerry" plumbing done in Sheffield. In these days of keen competition, there was naturally a tendency to look for the utmost profit out of labour and materials, and to make the first cost and profit the chief consideration. This tendency was disastrous both to the plumber and the public; and he was glad to know that this sort of thing was strongly deprecated by the Association. Dealing with the inspection of plumbing work by the officials of the Water Department, he said the practice of house-to-house inspection in Sheffield was saving an enormous amount of waste, and had reduced to the lowest limits the consumption of water per head of the population. If this was as great in Sheffield as in many other large towns, it would be necessary to construct an additional reservoir at a cost of £2,000,000 capital outlay and an annual expense of £100,000, which would represent a rate of 1s. 2d. in the pound. Mr. Terrey advocated the national registration of master plumbers by the Government—regarding such a scheme as being necessary in the interests of the public health and of the water supply. Moreover, it would also be a great inducement to good craftsmanship and technical education. In his opinion, it should not be lawful for a person to engage in plumbing who had not passed an examination and gained a certificate. The work was so important that no amateur or bad craftsman should have the power to jeopardize the public health. He thought the craft ought to be elevated to the rank of a profession.

Lighting of Waterford.—Considerable opposition has been manifested to a proposal by the Waterford Gas Company to apply to Parliament for powers to supply electricity within the city area. An electricity supply company in Dublin have intimated a like intention. The members of the Waterford Town Council have formed themselves into a Lighting Committee to deal with the proposals.

Messrs John Wright and Co. have again received from the Alliance and Dublin Gas Company the contract for the supply of all their requirements in high-grade cookers, slot-cooker installations, gas-radiators, gas-fires, &c., for a further period.

We have received from the Parkinson Stove Company, Limited, of High Holborn, a collection of pamphlets and leaflets furnishing full particulars of their "Crown," "Holborn," and other gas-cookers, oven griller, back plates and plate-racks, Maughan gas-geysers, and water-heaters.

At the invitation of the Directors, the united staffs of the Richmond Gas Stove and Meter Company, Limited, were last Thursday entertained at dinner at Warrington. A successful programme, arranged by the "R.G.S." Musical and Dramatic Society, followed, and was much enjoyed.

The Davis Gas Stove Company's "gilled circulator" business has increased to such an extent that they have found it necessary to reorganize the technical staff dealing with their hot-water department; and they have secured the services of Mr. W. Wenham, who has been connected for many years with Messrs. Wenham and Waters, Limited, of Croydon, who are probably among the largest firms of hot-water engineers in this country.

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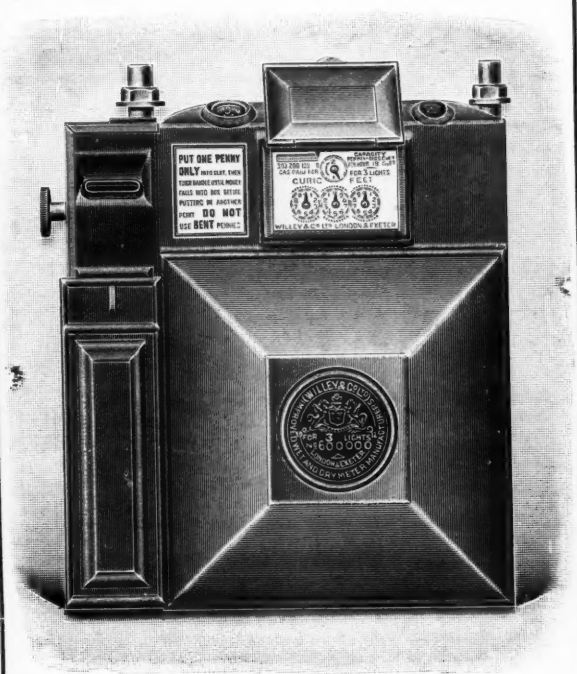

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The Board of Trade have granted a Provisional Order to the Alresford (Hants) Water Company for supplying New Alresford; the conditions being that they charge 7½ per cent. on property up to £100 per annum; and 5 per cent. on property above this value. The pumping powers of the Company are limited to 150,000 gallons per diem.

Messrs. Edward Cockey and Sons, Limited, of Frome, have recently secured the following contracts: Purifiers and lifting apparatus for the Melksham Gas Company; purifiers, valves, and connections for the Shoeburyness Urban District Council (this was a repeat order); and the installation of purifiers, valves, and roof for the Clacton Urban District Council.

GAS COMPANIES' STOCK AND SHARE LIST.

The week just closed on the Stock Exchange presented a great improvement over its predecessor. The change was perhaps all the more enjoyable because the signs at the opening were not conducive to cheerfulness, and the turn of events, when it came, was a pleasant surprise. Foreign affairs were the key of the position; and the raising of the black cloud brooding over Montenegro revealed a clear sky promising harmony between the Powers. Thus markets breathed freely, and rapidly gathered strength. None were more conspicious than the gilt-edged division; and the close was strong. But Monday's opening had been much depressed by the political situation, and, finding nothing to reassure them, markets continued to recede, and closed weak. Government issues dropped, and Consols fell ⅛ for money and ¼ for the account. Rails fell, too, but not very heavily. Americans zig-zagged and then gave way, and Foreign were weak. After a shaky start, Tuesday showed some sign of mending, and Rails found some support; but Government issues did not gain ground. On Wednesday, the Capel Court weather-glass rose a little, in step with rising hopes of peace; business was brisker and steadier, and most markets showed improved strength. On Thursday, the tone was quite cheerful, though business remained quiet. Government issues showed strength, and Consols advanced ¼. Rails were in good demand, and advanced their prices nicely; and the Foreign Market showed confidence. Americans were the exception, owing to special factors. Friday was quite happy. The outlook was regarded as promising for the adjustment of international difficulties in the way of peace; and the fortnightly settlement went through smoothly aided by cheap money. Nearly all markets benefited. Consols took a jump and Rails improved freely; but Americans still looked down. The favourable tendency lasted through Saturday; and all markets participated. Consols were done repeatedly at 75, and closed at 74⅞ to 75—a rise of ¾ in the week. In the Money Market, there was an abundant supply, and rates ruled easy. Business in the Gas Market was quieter; and more than the lion's share of it was in the premier Company. The rest were very quiet and featureless, save that one or two which do not often emerge from their repose now woke up and showed their quality. Transactions in Gaslight and Coke ordinary were numerous, and prices were very close, ranging from 102 to 102⅜. In the secured issues, the maximum realized 81 and 82, the preference from 95¼ to 97⅛, and the debenture from 72½ to 73½. South Metropolitan was quiet and steady at 112 to 112¾. In Commercials, one bargain in the 4 per cent. was marked at 106. Among the Suburban and Provincial group, Alliance and Dublin changed hands at 76½ and 77⅜, and Tottenham "B" at 115½ and 116. Variations in price, without actual business marked in the issues, are noted below. In the Continental companies, three or four bargains were recorded in Imperial at 172½ to 173½, Union preference was done at 130 free, and European at 17⅞ to 18⅛—a fall of ¼. Among the undertakings of the remoter world, Bombay realized from 6¾ to 6⅞, Monte Video 12¾, Oriental was quite active at 127½ to 129½ (a rise of 2), Primitiva fetched 6 15/16, ditto preference 5 and 5 1/16, and San Paulo preference 11 13/16 and 11¼.

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£			p.c.				£ s. d.
1,551,868	Stk.	April 11	5	Alliance & Dublin Ord.	73–78*	+½	6 8 2
374,000	,,	Jan. 16	4	Do. 4 p.c. Deb.	84–87	+1	4 12 0
280,000	5	April 11	7½	Bombay, Ltd.	6¼–6⅞*	..	5 11 1
50,000	10	Feb 27	15	Bourne- 10 p.c.	28½–29½	..	5 1 8
332,000	10	,,	7	mouth Gas B 7 p.c.	15⅝–16½	..	4 6 8
75,000	10	,,	6	and Water Pref. 6 p.c.	13½–14½	..	4 4 3
380,000	Stk.	Feb. 27	14	Brentford Consolidated	260–265	..	5 5 8
330,000	,,	,,	11	Do. New	200–205	..	5 7 4
50,000	,,	,,	5	Do. 5 p.c. Pref.	113–115	..	4 6 11
206,250	,,	Dec. 19	4	Do. 4 p.c. Deb.	94–96	..	4 3 4
217,380	Stk.	Feb. 27	11	Brighton & Hove Orig.	205–211	..	5 4 3
244,200	,,	,,	8	Do. A Ord. Stk.	151–154	..	5 3 11
530,000	20	Mar. 28	12½	British	44–45	..	5 11 1
120,000	Stk.	Dec. 30	4	Do. 4 p.c. Deb. Stk.	89–91	..	4 7 11
245,771	Stk.	,,	4	Buenos Ayres 4 p.c. Deb.	91½–93½	..	4 5 7
100,000	10	—	—	Cape Town & Dis., Ltd.	2–3	..	—
100,000	10	—	—	Do. 4½ p.c. Pref.	4–5	..	—
100,000	Stk.	Dec. 30	4½	Do. 4½ p.c. Deb. Stk.	78–83	..	5 8 5
157,150	Stk.	Feb. 13	5	Chester 5 p.c. Ord.	107½–109½	..	4 11 4
1,513,280	Stk.	Feb. 27	5/9/4	Commercial 4 p.c. Stk.	104–106	..	5 3 1
660,000	,,	,,	5¼	Do. 3½ p.c. do.	101–103	..	5 3 6
475,000	,,	Dec. 12	3	Do. 3 p.c. Deb. Stk.	71–73	..	4 2 2
800,000	Stk.	,,	4	Continental Union, Ltd.	84–87	..	4 12 0
200,000	,,	,,	7	Do. 7 p.c. Pref.	130–132	..	5 6 1
492,270	Stk.	—	5⅔	Derby Con. Stk.	124–125	..	4 12 0
55,000	,,	—	4	Do. Deb. Stk.	103–105	..	3 16 2
1,002,180	10	Jan. 16	10	European, Ltd.	17⅛–18⅛	–¼	5 8 1
16,415,840	Stk.	Feb. 18	4/17/4	Gas- 4 p.c. Ord.	101⅛–103½	..	4 14 2
2,600,000	,,	,,	3½	light 3½ p.c. max.	80–83	..	4 4 4
4,062,235	,,	,,	4	and 4 p.c. Con. Pref.	95–98	..	4 1 8
4,674,850	,,	Dec. 12	3	Coke 3 p.c. Con. Deb.	72–75	..	4 0 0
258,740	Stk.	Mar. 18	5	Hastings & St. L. 3½ p.c.	89–91	..	5 9 11
82,500	,,	,,	6½	Do. do. 5 p.c.	—	..	—
70,000	10	Oct. 11	11	Hongkong & China, Ltd.	17–17½	+½	6 5 9
131,000	Stk.	Mar. 18	7⅞	Ilford A and C	152–155	..	4 18 4
65,780	,,	,,	6⅛	Do. B	120–122	..	5 0 5
65,500	,,	Dec. 30	4	Do. 4 p.c. Deb.	89–91	..	4 7 11
4,940,000	Stk.	Nov. 14	9	Imperial Continental	171–176	..	5 2 3
1,235,000	Stk.	Feb. 13	3½	Do. 3½ p.c. Deb. Red.	85–87	..	4 0 6
200,342	Stk.	Mar. 13	6	Lea Bridge Ord. 5 p.c.	120–123	..	4 17 7
561,000	Stk.	Feb. 27	10	Liverpool United A	218–220	..	4 10 11
718,100	,,	,,	7	Do. B	155–157	..	4 9 2
306,083	,,	Dec. 30	4	Do. Deb. Stk.	98–100	..	4 0 0
63,480	Stk.	Jan. 16	3	Maidstone 3 p.c. Deb.	68–70	..	4 5 9
75,000	5	Nov. 28	6	Malta & Mediterranean	4⅛–4¼	..	6 6 4
250,000	100	April 1	4½	Met. of Melbourne 4½ p.c. Deb.	98–100	..	4 10 0
541,920	20	Oct. 30	3½	Monte Video, Ltd.	12⅞–13¼	..	5 5 8
1,775,892	Stk.	Feb. 27	4½	Newc'tle&G'tesh'd Con.	98⅝–99½	..	4 9 7
629,705	Stk.	Dec. 30	3½	Do. 3½ p.c. Deb.	85⅝–86½	+⅛	4 0 11
55,940	10	Feb. 27	7/7/0	North Middlesex 7 p.c.	13–14	..	5 4 7
800,000	Stk.	Nov. 28	8	Oriental, Ltd.	127–132	+2	6 1 3
60,000	5	Mar. 28	10	Ottoman, Ltd.	8–8½	..	5 17 8
60,000	50	Feb. 27	13	Portsea, Island B	125–128	..	5 1 7
100,000	50	,,	12	Do. C	122–125	..	4 16 0
249,980	5	Oct. 11	8	Primitiva Ord.	6½–7	..	5 14 4
499,960	5	Dec. 30	5	,, 5 p.c. Pref.	4⅛–5⅛	..	4 17 7
521,600	100	Dec. 2	4	,, 4 p.c. Deb.	96–98	..	4 1 8
346,198	Stk.	Dec. 30	4	River Plate 4 p.c. Deb.	92–94	..	4 5 1
275,000	5	Apl. 11	12	San Paulo, Ltd.	—	..	—
150,000	10	,,	6	Do. 6 p.c. Pref.	11¼–11⅜*	..	5 2 2
125,000	50	Jan. 2	5	Do. 5 p.c. Deb.	49–51	..	4 18 0
135,000	Stk.	Mar. 13	10	Sheffield A	224–226	..	4 8 6
209,984	,,	,,	10	Do. B	223–225	..	4 8 11
523,500	,,	,,	10	Do. C	224–226	..	4 8 6
90,000	10	Sept. 27	7½	South African	10–11	..	6 16 4
6,429,895	Stk.	Feb. 13	5/9/4	South Met., 4 p.c. Ord.	112–114	..	4 15 10
1,895,445	,,	Jan. 16	3	Do. 3 p.c. Deb.	73–75	–1½	4 0 0
209,820	Stk.	Feb. 27	8½	South Shields Con. Stk.	161–163	+1	5 4 4
952,795	Stk.	Feb. 27	6	S'th Suburb'n Ord. 5 p.c.	117–119	..	5 0 10
60,000	,,	,,	5	Do. 5 p.c. Pref.	115–117	..	4 5 6
117,058	,,	Dec. 30	5	Do. 5 p.c. Deb. Stk.	117–119	..	4 4 0
594,740	Stk.	Nov. 14	5	Southampton Ord.	102–105	..	4 15 3
120,000	Stk.	Feb. 13	7½	Tottenham A 5 p.c.	139–142	..	5 2 1
483,940	,,	,,	5⅔	and B 3½ p.c.	115–117	..	4 18 3
149,470	,,	Dec. 30	4	Edmonton 4 p.c. Deb.	92–94	..	4 5 1
182,380	10	,,	5	Tuscan, Ltd.	5–6	..	8 6 8
149,900	10	Jan. 2	5	Do. 5 p.c. Deb. Red.	96–98	..	5 2 0
236,476	Stk.	Feb. 27	5	Tynemouth, 5 p.c. max.	115–116	..	4 6 2
255,636	Stk.	Mar. 13	6⅔	Wands- B 3½ p.c.	137–140	..	4 18 2
85,766	,,	Dec. 30	3	worth 3 p.c. Deb. Stk.	63–70	..	4 5 9

Prices Marked * are "Ex. Div."

WANTED, FOR SALE, CONTRACTS, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

Appointments, &c., Vacant.

ENGINEER. Rochester, &c., Gas Company. Applications by May 8.
SECRETARY. Weston-super-Mare Gas Company. Applications by April 26.
MANAGER. Barbados Gas Company. Applications to London by April 24.
DRAUGHTSMAN. Drakes Limited, Halifax.
WORKING MANAGER. Bradford-on-Avon Gas-Works.

Appointments, &c., Wanted.

LEADBURNER. No. 5715.
LONDON GAS OR MANUFACTURER'S OFFICE. No. 5714.
EXPERIENCED STOKERS. Recommended by, and Particulars from, Redhill Gas Company.

Plant, &c. (Second-Hand), For Sale.

PIPES, GRAB, LOCOMOTIVE, &c. A. Mein, Station Street, Stratford, E.

Patent Licences, &c.

MANTLES. W. G. Potter, 45, Monsell Road, Finsbury Park, N.

Meetings.

IMPERIAL CONTINENTAL GAS ASSOCIATION. 21, Austin Friars, E.C., May 6, 2.30 o'clock.

Stocks and Shares.

ASCOT GAS AND ELECTRICITY COMPANY. London Mart. May 6.
BOGNOR GASLIGHT AND COKE COMPANY. London Mart. May 6.
GREAT YARMOUTH WATER COMPANY. London Mart. May 6.
SOUTHAMPTON GASLIGHT COMPANY. Tenders by April 15.
SUTTON GAS COMPANY. London Mart. May 6.
SWANSEA GASLIGHT COMPANY. By Auction. Hotel Metropole, Swansea. May 6.
WANDSWORTH, &c., GAS COMPANY. London Mart. May 20.

TENDERS FOR

Benzol, Crude (Wanted). No. 5718.

Coal.

BLACKPOOL GAS DEPARTMENT. Tenders by April 28.
COMMERCIAL GAS COMPANY. Tenders by April 17.
DENBIGH GAS COMPANY. Tenders by April 23.

Coal (*continued*)—

MONTROSE GASLIGHT COMPANY. Tenders by April 28.
OLDHAM GAS DEPARTMENT. Tenders by April 21.
TONBRIDGE GAS COMPANY. Tenders by April 29.

Exhausting Plant.

TEIGNMOUTH GAS DEPARTMENT. Tenders by May 5.

Gasholder.

THORNTON GAS DEPARTMENT. Tenders by May 1.

Mantles.

CALCUTTA CORPORATION. Tenders by May 12.

Purifier.

THORNTON GAS DEPARTMENF. Tenders by May 1.

Retorts.

JOHANNESBURG MUNICIPAL COUNCIL. Tenders by June 13.
TRALEE GAS-WORKS.

Steel Work.

JOHANNESBURG MUNICIPAL COUNCIL. Tenders by June 13.